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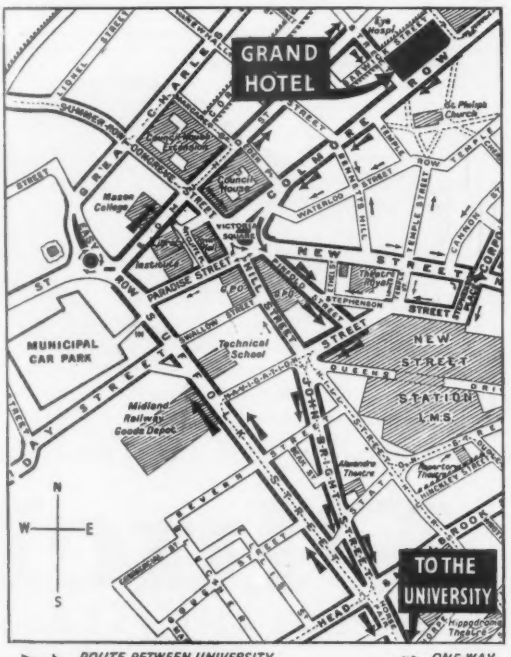

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BRITISH DENTAL JOURNAL

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ORIGINAL COMMUNICATIONS

ENAMEL CARIES: A CHEMICO-PHYSICAL HYPOTHESIS. PHASE ONE—CHEMICAL (cont.)

By J. L. HARDWICK, M.D.S.

University of Birmingham

In the first paper of this series,[1] a general review of the chemico-physical hypothesis was given. It is now necessary to consider in greater detail certain experimental evidence on the chemistry of enamel decalcification.

Experimental Technique

Recently extracted teeth were scaled to free them from tartar and were then thoroughly polished on a lathe to remove all surface debris and films from the crown and the periodontal remains from the root. A hole was drilled through the root of each tooth and the tooth suspended from the cork of a small specimen jar by a wire.

The specimen jar was thoroughly cleaned and 10 c.c. of the acid to be used in this particular experiment run into it. This acid was left in the jar for about an hour, poured out and the jar was then rinsed out with distilled water.

A further 5 c.c. of the acid was then run into the jar and the specimen jar cork replaced. The tooth was adjusted so that the crown was partially immersed in the acid. Various strengths of acid were used. With the stronger acids the greater portion of the crowns of large teeth, such as molars, were immersed in the acid; with the more dilute acids only the tips of the crowns of smaller teeth such as lower incisors were immersed.

Each day the tooth was completely removed from the acid while the specimen jar was shaken to mix the acid. This removal of the tooth was found to be necessary because with some of the organic acids, including lactic acid, it was found that a fungus growth developed on the root within a period of seven to ten days if the root became moistened.

[1] (1949) *Brit. dent. J.*, **87**, 137.

The teeth were finally removed from the acid after eight days and the calcium and phosphorus content and the pH of the liquid were estimated by Dr. D. L. Woodhouse and Mr. P. W. Perryman. Some preliminary experiments had shown that a large rise in the pH of the acid occurred in the first twenty-four hours after immersion of the tooth, a smaller rise in the next twenty-four hours and that with most of the experiments no appreciable rise occurred after about four days.

The Method for the Estimation of the Calcium and Phosphorus Content.—Dr. Woodhouse estimated the phosphorus content of the liquid by the method according to Holman [1] and the calcium content by the method according to Hilversum and Borgheim [2], using suitably diluted proportions of the solutions instead of the serum filtrates. The calcium content was estimated by the method of Kramer and Tisdall [3] and the phosphorus content by the method of Kuttner and Cohen [4], by Mr. Perryman. The results obtained by both Dr. Woodhouse and by Mr. Perryman agreed closely.

Lactic and Hydrochloric Acid.—Most of the experiments were carried out with varying strengths of lactic and hydrochloric acids. The actions of these two acids were chosen for a more thorough investigation because:

(1) Their calcium salts were highly soluble.

(2) Lactic acid is thought by many people to be the principal acid producing decalcification of enamel in caries.

The macroscopical appearance of the teeth following attack by these two acids was observed. It was noted that:

(i) The strong inorganic acid (i.e. $\frac{N}{1}$ hydrochloric acid) removed the enamel nearly com-

pletely—due to the complete disintegration of the enamel structure. Shreds of organic matter were often seen floating in the acid medium.

(ii) The $\frac{N}{1}$, $\frac{N}{10}$ and sometimes the $\frac{N}{100}$ lactic acid and the $\frac{N}{10}$ hydrochloric acid produced a marked white opacity where it had come into contact with the enamel. Such enamel was greatly softened and, especially in the case of $\frac{N}{1}$ lactic acid, would tend to be dislodged from the underlying undecalcified tissue if subjected to rough movements.

(iii) The dilute acids (i.e. $\frac{N}{1000}$ lactic acid, $\frac{N}{100}$ and $\frac{N}{1000}$ hydrochloric and sometimes $\frac{N}{100}$ lactic acid) produced no macroscopical change in the enamel structure.

The results of the investigations of the residual liquids are shown in Table I. Each figure given is the average obtained from a minimum of three experiments with that acid. A column entitled " Adsorption of dyes on etched surface " is included as it was found that by this method small degrees of decalcification not otherwise visible could be demonstrated. In a subsequent paper the method for obtaining this adsorption will be described and its significance discussed.

Remarks on the Results of the Experiments.—It will be noted in Table I that :

(1) The calcium and phosphorus contents are not yet large enough to suggest that the liquid was completely saturated as to calcium and phosphorus. (Thus at a pH as high as 7·4 it is to be expected that the (calcium content) × (phosphorus content) = 40 when the calcium and phosphorus contents are expressed in milligrams per cent.)

(2) With both acids, the calcium content of the liquid phase at equilibrium with the enamel surface varies approximately with the hydrogen-ion concentration of the liquid phase. About seven times as much calcium dissolves from the enamel for each drop of 1·0 pH in the liquid phase. A similar correlation between the hydrogen-ion and calcium concentrations has been shown to exist for the solution of tricalcium phosphate by acids by Kramer and Shear [5].

(3) It is doubtful whether great reliance can be placed on the calcium and phosphorus contents of the $\frac{N}{1000}$ acids because :

(i) The contents are so small as to make accurate estimation difficult.

(ii) The initial pH of the $\frac{N}{1000}$ lactic acid is about 3·7. Growth of fungi might occur at such a pH in lactic acid and not be appreciated. The calcium and phosphorus contents might thus be upset.

(4) With the stronger acids the Ca/P ratio is about 15. With weak $\frac{N}{1000}$ hydrochloric acid it is only about 2·0. It is generally accepted that the

TABLE I.—RESULTS OF INVESTIGATION OF RESIDUAL LIQUIDS AFTER IMMERSION OF TOOTH FOR EIGHT DAYS

Decalcifying medium	*Initial pH*	*Final pH*	*Calcium content mg. per cent*	*Phosphorus content mg. per cent*	*Ca/P ratio*	*Opacity of etched enamel*	*Adsorption of dyes in etched enamel*
$\frac{N}{1}$ lactic acid... ...	1·9	3·6	1,540	97	15·9	+++	++
$\frac{N}{10}$ lactic acid ...	2·4	4·0	215	17·7	12·2	++	++
$\frac{N}{100}$ lactic acid ...	2·9	5·3	24	7·7	3·1	+	++
$\frac{N}{1000}$ lactic acid ...	3·6	6·1	3·3	3·9	0·8	—	++
$\frac{N}{1}$ hydrochloric acid...	0·15	2·4	2,640	172	15·3	+++ most of the enamel had disintegrated	++
$\frac{N}{10}$ hydrochloric acid	1·0	3·9	285	23·9	11·9	++	++
$\frac{N}{100}$ hydrochloric acid	2·0	5·1	27·9	7·2	3·9	—	++
$\frac{N}{1000}$ hydrochloric acid	3·0	5·9	3·3	1·7	2·0	—	++

Ca/P ratio in normal enamel is about 2·10. It is therefore obvious that with all the acids examined, except the $\frac{N}{1000}$ acids, relatively more calcium than inorganic phosphorus is being removed from the enamel. This must arise from the " calcium carbonate " dissolving more rapidly than the " calcium phosphate," thus providing an excess of calcium in the solution.

The Theoretical Aspects of Enamel Decalcification.—Considerable research has been done on the chemical and physical structure of the inorganic components of the enamel. Following the work of Dallemagne and Melon [6, 7, 8 and 9], it is now generally accepted that the inorganic structures of the enamel contain 60 per cent carbonate-apatite, 30 per cent *a* tricalcium phosphate, 1 per cent calcium carbonate.

Much confusion will arise if the apatites are regarded as being definite molecular entities to which a chemical formula may be assigned. The ions within an apatite crystal show a regular arrangement within a space lattice, but considerable substitution of suitable ions may occur without that lattice being destroyed. (The picture is also complicated by the fact that the lattices of the apatites and of *a* tricalcium phosphate are very similar.) Therefore quantitative analysis of apatites may show considerable variations in the components of the apatite crystals.

If enamel is dissolved, the dissolving fluid will not finally contain dissociated and undissociated apatite molecules and ions ; it will contain undissociated and dissociated " calcium phosphate," " calcium carbonate," " magnesium phosphate," etc. Most of these inorganic substances will be in ionic state. If such a solution is concentrated, it will eventually become supersaturated with regard to these substances and reprecipitation will occur. Under suitable conditions the precipitation will not occur in the form of calcium phosphate, calcium carbonate, etc., but rather as recrystallisation with the reformation of apatite crystals. In fact, it is extremely difficult to obtain pure tricalcium phosphate without contamination by apatites because the apatite lattice so readily forms.

In the first paper of this series the inorganic constituents of enamel apart from calcium phosphate and carbonate were disregarded in order to simplify the reactions. A similar procedure will be adopted here.

Assuming therefore that the solution surrounding the enamel contains only dissociated and undissociated calcium phosphate and carbonate, it is tempting to think that further solution or reprecipitation of these salts will occur according to the comparatively simple solubility product[1] laws until an equilibrium is reached with the enamel surface. This is not so. For instance, it is well known that the interface of any calcium phosphate solid phase at equilibrium with an aqueous calcium phosphate liquid phase is more basic than the liquid phase.

Apart from this, it is necessary to consider in what state the " phosphate " and " carbonates " will exist within the liquid phase. The percentage ionic states of orthophosphoric and carbonic acids at varying pHs are shown in the diagram (fig. 1). In the experiments which are about to

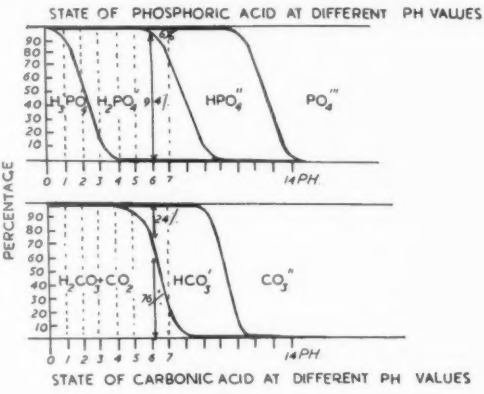

FIG. 1.

be described, the pHs varied up to about 6·1 and it will be seen therefore that the phosphoric acid will have existed largely as undissociated phosphoric acid, H_3PO_4, or as H_2PO_4' ions and the carbonic acid as undissociated carbonic acid or carbon dioxide and water (H_2CO_3 or CO_2 and H_2O), or as $H\,CO_3'$ ions. As these experiments were conducted over considerable periods there will be time for undissociated carbonic acid to break down to carbon dioxide which will largely be evolved from the liquid phase.

$$H_2CO_3 = H_2O + CO_2$$

Consideration of these facts would suggest that solution is unlikely to occur in accordance with the solubility products of tricalcium phosphate or calcium carbonate. In fact, as has been pointed out by Kramer and Shear [5] and Logan [10] there is considerable evidence to suggest that within the body fluids (pH 7·4) precipitation occurs as a result of their becoming supersaturated with regard to monohydrogen calcium phosphate and not tricalcium phosphate.

[1] The solubility product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

It will be noted that at pHs below 4·5, the carbonic acid exists practically entirely in the undissociated state (H_2CO_3). Such undissociated carbonic acid will tend to break up with the evolution of carbon dioxide. In the experiments conducted below this pH, carbon dioxide will be evolved and further $H CO_3'$ ions will therefore associate with H' ions to form undissociated carbonic acid. The $H CO_3'$ concentration will therefore fall and further carbonate will dissolve from the enamel to maintain the equilibrium. A similar mechanism is not available for the solution of the phosphate. On theoretical grounds a differential solution of the carbonates and phosphates from the enamel is to be expected, a greater proportion of carbonate being dissolved the lower the pH. In other words, the Ca/P ratio in the liquid phase following solution will be greater the lower the pH of the liquid.

Despite this increase in the Ca/P ratio in the lower pH ranges, the amount of "phosphate" dissolved will also increase with the fall in pH, but to a less extent than the "carbonate." This occurs because dihydrogen calcium phosphate is more soluble than the monohydrogen calcium phosphate which is again more soluble than the tricalcium phosphate. As the pH falls down to the range in which most of the phosphoric acid exists in undissociated state, H_3PO_4, still further solution of the phosphates will occur.

Some difficulty may be caused by the fact that in these experiments the liquid phase had not yet become fully saturated as to calcium and phosphate at the end of the experiment. It is probable that a very considerable time, perhaps even years, would have to elapse before complete equilibrium with the enamel was obtained and the liquid phase became completely saturated with calcium and phosphate ions. This difficulty is more apparent than real. When the ions of the enamel crystals pass into solution, it must be realised that there will be a certain number of ions reattaching themselves to the apatite lattice from the liquid phase. Thus when the liquid phase is just saturated with calcium and phosphate ions, the loss of ions from the liquid phase to the crystal lattice will equal the loss of ions from the crystal lattice to the liquid phase. Before the liquid phase is saturated, there is a net loss of ions from the crystal lattice to the liquid phase. If the liquid phase contains few $H CO_3'$ ions (due to the evolution of carbon dioxide) and many "phosphate" ions, few carbonate ions will pass from the liquid phase into the crystal lattice whereas many "phosphate" ions will do so. There will be therefore a relatively large net loss of carbonate ions from the crystal lattice and a small net loss of phosphate ions from the crystal lattice.

Some Further "In Vitro" Experimental Evidence.—Some further experiments using a similar technique were carried out with $\frac{N}{1}$, $\frac{N}{10}$, $\frac{N}{100}$ and $\frac{N}{1000}$ lactic acid. Previous to the immersion of the tooth in this acid 2 grm. of calcium carbonate were added to the liquid.

It was found that in the experiments with the $\frac{N}{10}$, $\frac{N}{100}$ and $\frac{N}{1000}$ lactic acid, undissolved calcium carbonate powder was still present at the end of the experiment. No macroscopical change in the appearance of the enamel was produced and dyes were not adsorbed on the enamel surface which had been immersed in the acid. Only traces of phosphorus too small to be estimated were found in the liquid at the end of eight days. In these three experiments the calcium carbonate powder was attacked first, the acid was neutralised and the pH raised so high that no appreciable solution of either calcium phosphate or the carbonate of the enamel crystals could occur. The excess of calcium carbonate powder remained at the bottom of the specimen jar.

With $\frac{N}{1}$ lactic acid, the whole of the calcium carbonate powder was dissolved. The enamel of the tooth became opaque and would adsorb dyes on the etched surface. The phosphorus content and pH of the residual liquid at the end of the experiment were found to be about what would normally be expected with $\frac{N}{1}$ lactic acid alone.

Experiments with Other Acids.—Single experiments to estimate the calcium and phosphorus contents of the residual liquid were made following the immersion of teeth in other acids.

(*a*) With nitric acid whose calcium salt is also highly soluble, results similar to those obtained with lactic and hydrochloric acids were found (Table II).

TABLE II.—COMPARISON OF RESIDUAL LIQUIDS USING NITRIC AND HYDROCHLORIC ACIDS

	Final pH	*Ca content*	*Phosphorus content*
$\frac{N}{100}$ nitric acid	4·8	17	11·5
$\frac{N}{100}$ hydrochloric acid	5·1	27·9	7·2
$\frac{N}{1000}$ nitric acid...	5·9	3	2
$\frac{N}{1000}$ hydrochloric acid ...	5·9	3·3	1·7

(*b*) Experiments were also performed with acids which form insoluble salts with calcium (Table III).

TABLE III.—RESIDUAL LIQUIDS USING ACIDS WHICH FORM INSOLUBLE SALTS WITH CALCIUM

Acid	*Final pH*	*Ca content*	*Phosphorus content*
$\frac{N}{10}$ hydrochloric acid ...	3·9	285	23·9
$\frac{N}{10}$ oxalic acid	2·0	0·4	5·2
$\frac{N}{10}$ sulphuric acid	3·0	35	32
$\frac{N}{100}$ hydrochloric acid ...	5·1	27·9	7·2
$\frac{N}{100}$ sulphuric acid... ...	4·0	0·9	3·3
$\frac{N}{1000}$ hydrochloric acid ...	5·9	3·3	1·7
$\frac{N}{1000}$ sulphuric acid ...	4·2	0·5	1·4

With those acids which form insoluble salts with calcium, the reaction would be modified in two ways :

(1) There will be a tendency to form an insoluble salt on the outside of the enamel which will tend to prevent penetration of the acid into the deeper tissues.

(2) Apart from this, solution will tend to proceed until a balance is obtained between the calcium ions, the acid ions, phosphate ions and the carbonate ions in accordance with the solubility products of the calcium salts of the acid, one of the calcium phosphates and one of the calcium carbonates. On theoretical grounds therefore final equilibrium might be expected to be reached :

(*a*) With a final pH considerably lower than that for the corresponding strength of lactic and hydrochloric acid.

(*b*) With lower calcium and phosphorus contents in the liquid phase. As the pH at equilibrium is considerably lower than when decalcification is obtained by the attack with hydrochloric or lactic acids, a greater proportion of the phosphoric acid will be undissociated. Therefore the fall in the calcium content of the liquid phase at equilibrium may be expected to be greater than the fall of the phosphorus content.

(*c*) With the calcium and phosphorus contents lowest with those acids whose calcium salts have the lowest solubility products. Thus oxalic acid (solubility product of calcium oxalate $2{\cdot}0 \times 10^{-9}$) would dissolve less of the enamel structure than sulphuric acid (solubility product of calcium sulphate $6{\cdot}0 \times 10^{-5}$).

It will be seen that the theoretical deductions agree with the experimental findings.

The very low Ca/P ratio (for instance 0·08 for $\frac{N}{10}$ oxalic acid) is explained by the substitution of oxalic acid radicles for phosphate radicles on the surface of the tooth, thus forming a surface layer of calcium oxalate.

In this series of experiments another phenomenon became more noticeable. Because equilibrium is achieved at a lower pH than with hydrochloric and lactic acids, most of the carbonic acid will exist in the form of undissociated carbonic acid. There will therefore be a marked tendency for carbon dioxide to be evolved. As this evolution occurs the pH of the liquid phase will rise and the acids (i.e. phosphoric, carbonic and the added acid) will become dissociated to a greater extent. The solubility products of the calcium phosphate, carbonate and "added acidate" will then be exceeded and recrystallisation of these calcium salts will tend to occur either on the enamel surface or at the bottom of the specimen jar. This recrystallisation usually occurs after about two or three days. It was most noticeable with citric and oxalic acids but occurs to a less extent with several acids.

"In Vitro" Acid Decalcification of Enamel and Acidogenic Caries

Any deductions concerning the chemistry of acid decalcification made as a result of *in vitro* experiments may of course undergo considerable modification before similar deductions can be applied to acidogenic caries. They cannot be applied to proteolytic caries except in as far as acids are being produced as a secondary result of proteolysis.

In the experiments that have been described, the conditions have been carefully controlled in order to simplify the chemical reactions, but even then it can be seen that the chemistry is very complicated. In acidogenic caries the liquid phase is the saliva which is such a complex secretion that any attempt to be dogmatic with regard to the chemical reactions is unthinkable. For instance, the fact that complex ions may be formed by the interaction with substances present in the saliva produces great complications.

In addition, the presence of enzyme systems within the saliva may influence the rate of reaction very considerably. Thus the presence of carbonic anhydrase in the saliva [11] would tend to increase the rate of solution of carbonates by facilitating a rapid evolution of carbon dioxide [12], but it might be expected that in the

saliva its influence would be inhibited by the thiocyanates [13] present. Similarly the presence of phosphorylases and phosphatases will have considerable effect on the rate of solution of the phosphates.

In acidogenic caries, the pH of the enamel surface will be relatively constant because any acid formation will be so slow that the solution of the enamel and the diffusion of the acid into the main body of the oral cavity will tend to keep it constant. In these experiments the pH was allowed to rise considerably during the course of the experiments as the solution of the enamel neutralised the acids; in most of the experiments the rise in pH was about 2·0.

Despite these differences, it is considered that some of the deductions may be applied to decalcification occurring in acidogenic caries.

(1) It is not true to state that enamel decalcification only occurs below certain pHs. The composition of the liquid producing the decalcification must be known besides its pH because the presence of calcium, phosphate, carbonate and other ions will modify or inhibit its decalcifying action. Absolutely pure water (pH 7·0) will tend to decalcify enamel to a nearly infinitesimal extent. On the other hand, in the mouth, adsorbed films on the enamel interface may protect the enamel from decalcification at pHs above a certain figure in the saliva outside that interfacial film.

(2) A differential decalcification of enamel may occur resulting in the removal of more acidic radicles of one kind than of another. A relatively rapid removal of carbonate radicles will occur at pHs slightly below that at which carbonic acid exists largely as undissociated carbonic acid or as carbon dioxide. A rapid increase occurs at pHs below 4·5. At pHs very considerably below 4·5, the chemical action is likely to be so energetic that the enamel structure will be disintegrated by the rapid evolution of carbon dioxide.

(3) Those acids which form "insoluble" salts with calcium may also produce appreciable decalcification if the pH is low enough. In very dilute solutions their effect will be nearly comparable with that produced by similar strengths of lactic acid. This may be of importance because acids such as sulphuric acid may be produced by proteolysis. Therefore it is not logical to state that acidogenic caries may only be produced by carbohydrate fermentation.

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My grateful thanks are due to Dr. D. L. Woodhouse of the University of Birmingham and to Mr. P. W. Perryman of the Queen Elizabeth Hospital, Birmingham, for performing the necessary estimations on the liquids.

I am also indebted to Dr. Woodhouse for much helpful criticism and encouragement.

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A STUDY OF SOME OF THE DEVELOPMENTAL, STRUCTURAL AND PATHOLOGICAL ASPECTS OF TUBULAR HYPOPLASIA IN HUMAN ENAMEL

BY J. J. HODSON, B.D.S.SHEFF., L.D.S.EDIN.

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PART I

THERE exist in the human enamel of some teeth open paths which take the form of tubule-like invaginations of the enamel capsule (primary cuticle) to within reach of the tuft and amelo-dentinal region (Hodson, 1949*a*). This condition has been called tubular hypoplasia to differentiate it from the more superficial defects of M-hypoplasia and the larger-surfaced G-hypoplasia. Some G-hypoplastic defects may be of the tubular type. For descriptive purposes the structures are called enamel or hypoplastic tubes. The reader is referred to the above-mentioned paper for the introduction to the subject.

Further evidence is presented and it is proposed to discuss the various anomalies in the light of the general picture already published. The method used was similar to that already outlined.

The sections of developing enamel were de-

calcified in 25 per cent HCl in absolute methyl alcohol and double embedded. The same solution was used for the isolation of the structures using the original micro-dissection technique. The histological sections of the mature adult enamel were decalcified first in 75 per cent formic acid (50 per cent) in absolute methyl alcohol and, after embedding and cutting, the sections were treated with 5 per cent nitric in 80 per cent alcohol. It is not easy to obtain perfect sections showing tubular hypoplasia since their depth causes, in the case of ground sections, early splitting of the enamel and, in the case of decalcified sections, folding and tearing of the sections. This is a cause of the defects being overlooked.

The identity of the hypoplastic tubes found by sectioning of decalcified and undecalcified enamel, and those obtained by micro-dissection, leave no doubt that the structures exist. The ground section shown in fig. 1 was taken from

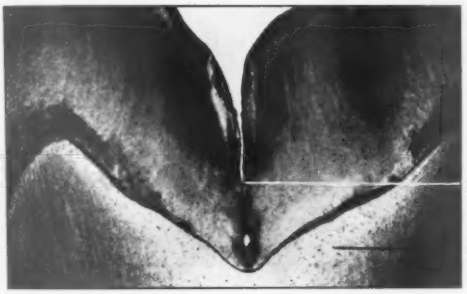


FIG. 1.—Unstained ground longitudinal section from the mesial aspect of a partially erupted lower permanent first molar. × 15. X. = Mesio-distal groove base. D. = Dentine.

the mesial aspect of a partially erupted lower second permanent molar from a child aged 11 years. It was ground thin enough and without splitting so that the tube was entered and the contents washed out. The mesio-distal groove which is rather deep is considered as ending at the point X. The deeper space appears to be of a different character. Mesial and distal to the section this deeper part did not exist. This open tract from the mouth to within reach of the dentinal surface is a hypoplastic tube which by decalcification can be shown to be lined by the enamel capsule. In order to ascertain the extent of T-hypoplasia in this specimen, the remainder was decalcified and prepared for micro-dissection in the manner already indicated. Fig. 2 is a photograph of the cleared specimen viewed from the mesial surface and showing in depth the outlines of the invaginations. Five or six areas can be seen.

Although this double illustration using decalcified and undecalcified preparations of the same specimen is from a young specimen, the developmental origin of these defects can be

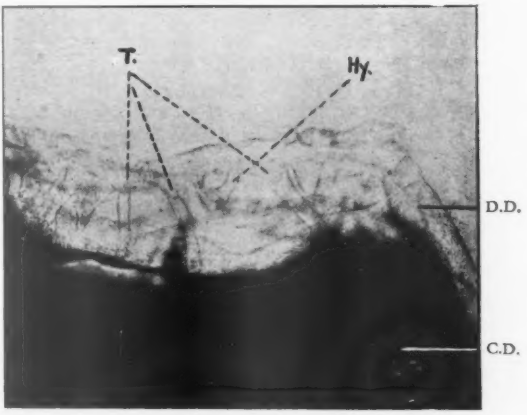


FIG. 2.—Micro-dissection preparation of the remainder of the molar used for fig. 1. Photographed from mesial aspect by transmitted light. Embedded in celloidin-benzoate. × 15. T. = Hypoplastic tubes. Hy. = Hypoplastic pits. D.D. = Cleared decalcified dentine. C.D. = Calcified dentine.

traced in much earlier material. The best picture is obtained when the matrix is almost fully laid down when the defect can be studied in relation to the surrounding matrix. Fig. 3 shows a hypoplastic tube of the flattened type in a developing first upper permanent molar from a child aged 13 months. The matrix of the enamel was not quite fully laid down, more particularly in the cervical area. When removed from the jaw the crown was fairly hard, and the surface ameloblasts, where they remained in place, were very tall. The deeper part of the defect is comparable to that in fig. 1; that it is different from the upper part can be ascertained from a study of the decalcified serial sections. The area GX in fig. 3 seems to be an abnormal deepening of the groove. In fig. 4 the area is being filled up. In fig. 5 it will be seen that the hypoplastic tube did not exist and the area GX in fig. 1 became a defect in the coalescence of the two enamel lobes. The stage of development and the depth of the lesion suggests that no more matrix would be laid down to cause these areas to coalesce. The section in fig. 6 shows the absence of any defects and a normal configuration of the enamel

matrix. Figs. 7, 8 and 9 show transverse sections of hypoplastic tubular defects in a developing deciduous second molar from a baby aged 8 months.

The hypoplastic tube defects are developmentally similar but differently shaped and deeper versions of the M and G hypoplasias. Pathologically they are more important. All three types are manifestations of arrested amelogenesis. These areas are frequently, but not always, associated with defective matrix formation. Defective amelogenesis also occurs in areas where there are no hypoplastic defects of arrested amelogenesis type. It is worthy of note that defective amelogenesis seems to be most frequent in groove regions and on the enamel surface. The association of M- and T-hypoplastic lesions can often be found in the same specimen. A typical M-hypoplastic pit is shown in figs. 10 and 11 (the same specimen as fig. 3). The defect shown is on the occlusal surface and relatively superficial. Fig. 10 shows the connection with the surface and degenerating cellular contents. Fig. 11 shows the same area a few sections away and the penetrating character of the base of the defect. A striking feature is the defective character of the matrix laid down around the area of non-amelogenesis. It is composed of ground substance devoid of the classical "prismatic" structure. Fig. 12 is a photograph of a section through the base of a tubular hypoplastic lesion (i.e. non-amelogenesis) from a partially erupted second permanent molar with similar defective amelogenesis surrounding its base.

A further example of non-amelogenesis was found in an area other than an anatomical groove. Figs. 13, 14 and 15 show three sections of a non-coalesced area on a cusp in which the defect is ultimately filled, with the exception histologically of a small area of retained ameloblasts. Although the section in fig. 15 is badly torn, the area of ameloblasts is well defined. The base is thus broad and penetrating. Such an area would be difficult to interpret in a ground section of a fully developed specimen. It is likely that it would appear as a necrotic dark mass easily mistaken for dental caries.

It is impossible to isolate the hypoplastic tubes in the early developmental stages since until a certain advanced degree of calcification has been reached the enamel matrix cannot be removed by decalcification. It is interesting, however, to study the characters of the structures in enamel in a more calcified condition (secondary calcification or maturation) yet at the same time unerupted. Figs. 16 and 17

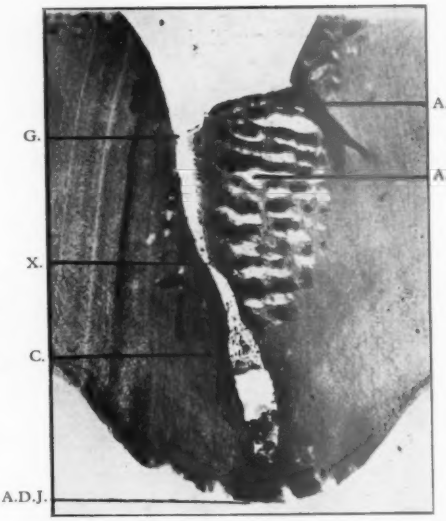


FIG. 3.—Longitudinal section of developing first upper permanent molar from child aged 13 months. Stained hæmatoxylin and eosin. × 59. G–X. = An abnormal deepening of the occlusal groove. C. = Epithelial cells of enamel organ. A.C. = Artefact crease. A.T. = Artefact tears. A.D.J. = Amelo-dentinal junction.

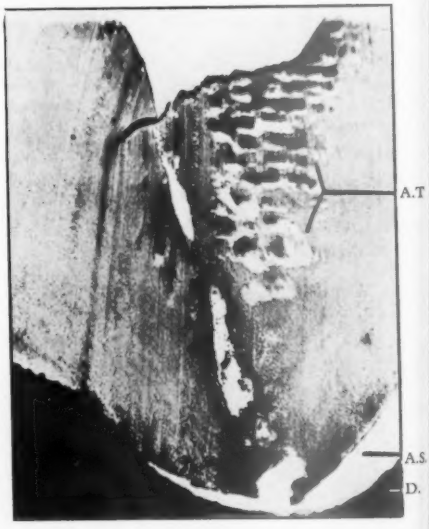


FIG. 4.—Serial section from fig. 3. × 59. D. = Dentine A.S. = Artefact space.

show the gross characters of isolated hypoplastic tubes from a second permanent molar just prior to eruption. There is doubtless some "spread" when these structures are isolated from their calcified surroundings. Fig. 18 shows two tubular structures from the central occlusal area of an unerupted temporary second molar.

FIG. 5.—Serial section from fig. 3. × 59.

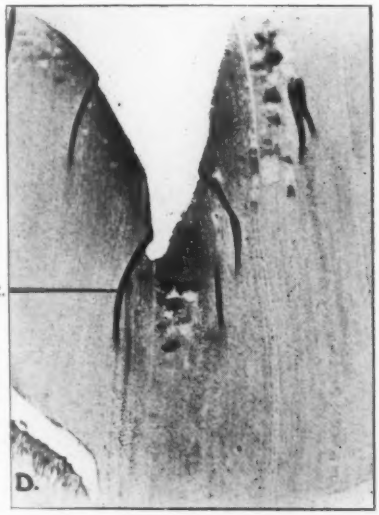


FIG. 6.—Serial section from fig. 3. × 59.

The tube in fig. 16 photographed by transmitted light is seen to be deeply inserted into the amelodentinal matrix. Fig. 20 shows histological sections of an isolated hypoplastic tube from the same specimen as the illustrations in figs. 16 and 17. It has been observed that a rather thick area of enamel matrix is frequently retained at the base of these structures, not only in the non-erupted specimen (where it might be expected) but also in the adult mature enamel. It is rare to find this in M-hypoplastic areas but it is frequent in fissures containing lamellæ. Histological examination of the adult

FIG. 7.—Transverse section of central occlusal surface towards the dentine of developing second deciduous molar from baby age 8 months. Stained hæmatoxylin and eosin. × 44. D. = Space occupied by dentine. H. = Hypoplastic tubes.

FIG. 8.—High-power view of lower left tube in fig. 7. Stained hæmatoxylin and eosin. × 455. S. = Space filled with degenerated cells of enamel organ. D.M. = Defective matrix.

material shows some of it to be non-matured enamel with the full content of what at present may be called the "prism core" protein retained. This immature matrix is particularly frequent in the tuft area. Fig. 19 shows a bifurcated tubular defect from a young partially erupted upper molar which, photographed by reflected light, illustrates the thick amelo-dentinal matrix into which the tube bases are inserted. Thus not only is there absence of, and defective, amelogenesis but also defective maturation. In some cases there are also areas where the lining capsule is absent and an acidophilic ground substance with few or no "classical prisms" occupies the margin. There is therefore continuity between the open matrix and the

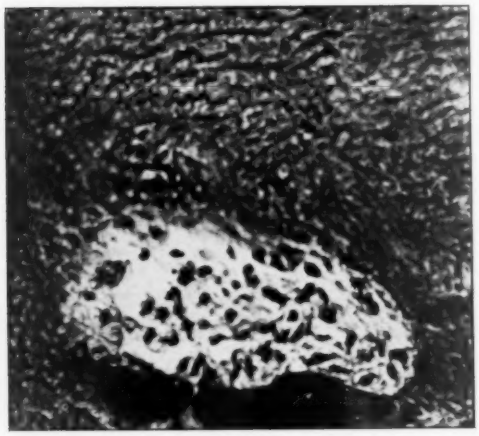


FIG. 9.—High-power view of upper left tube in fig. 7, showing epithelial contents. Stained hæmatoxylin and eosin. × 455.

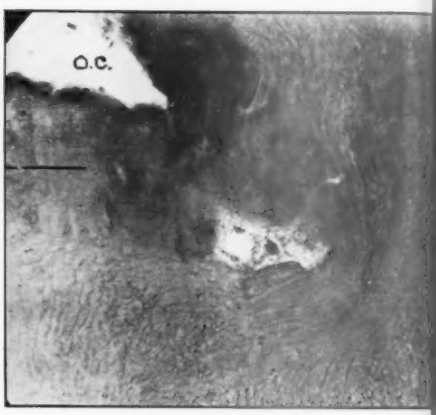


FIG. 11.—From the same area as fig. 10, showing tration of the base of the pit. × 364.

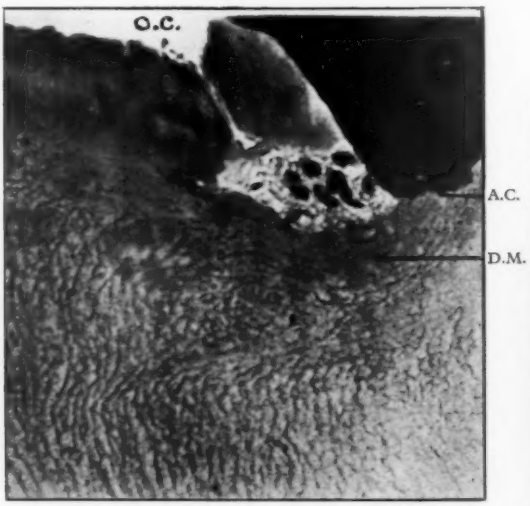


FIG. 10.—A longitudinal section of an M-hypoplastic defect on the occlusal surface showing degenerating enamel epithelium and the connection with the surface. From the same crown as in fig. 3. Stained hæmatoxylin and eosin. × 455. O.C. = Occlusal surface. A.C. = Artefact crease. D.M. = Defective matrix.

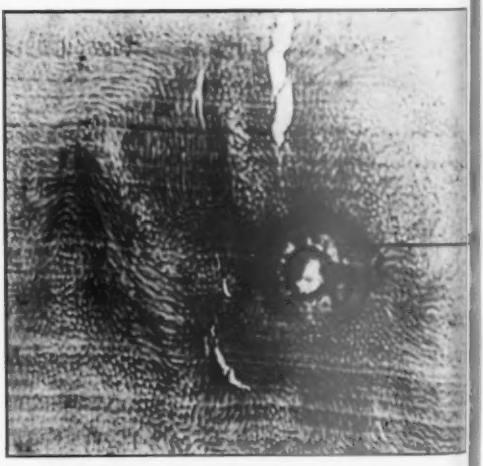


FIG. 12.—A transverse section of the base of a hypoplastic tube from an erupted second permanent molar. Stained hæmatoxylin and eosin. × 216. D.M. = Defective matrix.

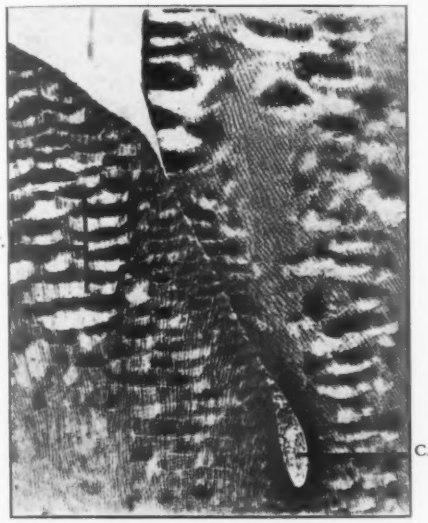


FIG. 13.—A longitudinal section from the same specimen used for fig. 3, showing an area of non-coalescence of enamel matrix on a cusp. Stained hæmatoxylin and eosin. × 91. A.T. × Artefact tears. C. = Cells of enamel organ.

tube contents. The importance of such areas in the pathology of caries is self-evident.

The developmental aspect of the hypoplastic and groove defects presented above would seem to put on a clearer footing the evidence for the occurrence of defects (fissures) in the

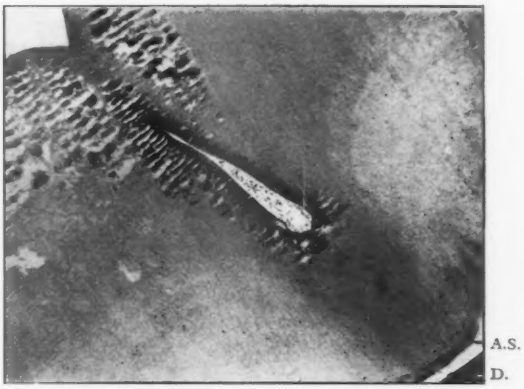


FIG. 14.—From the same series as fig. 13, showing closure of the outer part of the defect. × 44. A.S. = Artefact space. D. = Dentine.

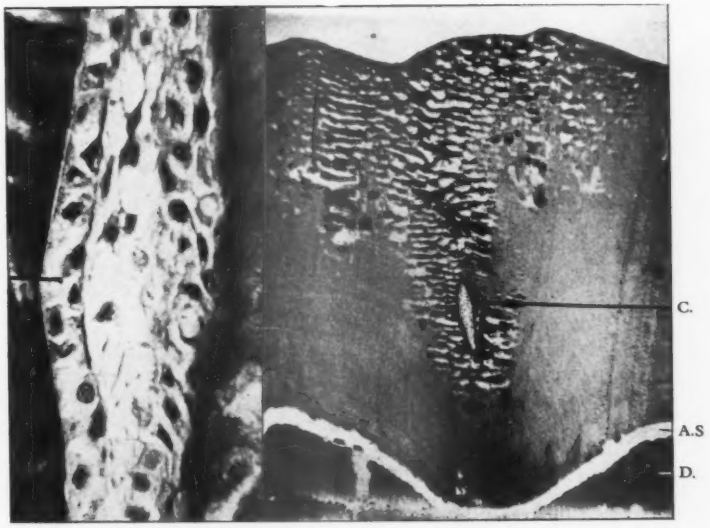


FIG. 15.—From the same series as fig. 13, showing retained island of enamel epithelium. × 36. C. = Cells of the enamel organ. A.S. = Artefact space. D. = Dentine. A.M. = High-power view of the island showing degenerating ameloblasts. × 455.

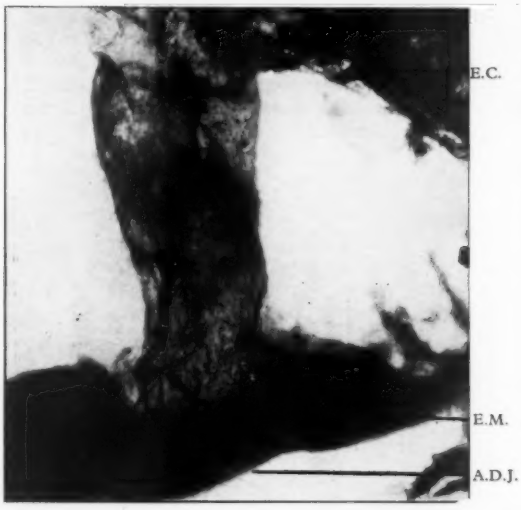
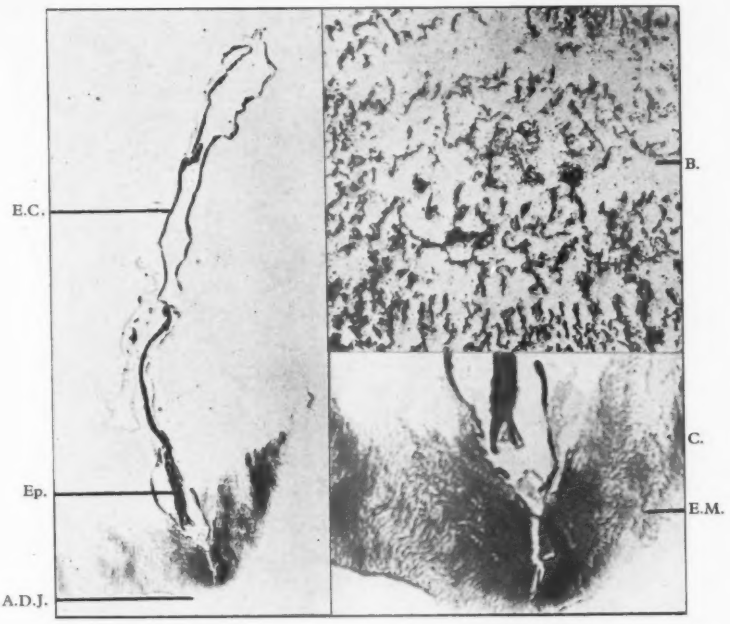


FIG. 16.—Hypoplastic tube dissected from an unerupted upper second permanent molar from child aged 11 years. Photographed by transmitted light. Embedded in celloidin-benzoate. Stained eosin. × 56. E.C. = Enamel capsule. E.M. = Enamel matrix. A.D.J. = Amelo-dentinal junction.

FIG. 18.—Two hypoplastic tubes from central occlusal area of unerupted temporary second molar. Stained eosin, embedded in gelatine. × 46.

FIG. 17.—Fissure from a central groove in an unerupted upper second molar—shows two tubes and two pits. No lamellar tissue present between the defects. Embedded in celloidin-benzoate. Photographed by transmitted light. × 44. Hy. = Hypoplastic pit. E.C. = Enamel capsule. E.M. = Enamel matrix at amelo-dentinal junction. H.T. = Hypoplastic tube.

FIG. 19.—Double or bifurcating hypoplastic tu from a partially erupted upper molar. Photographed reflected light. Embedded in gelatine, stained gent violet and eosin. × 36.



A.

FIG. 20.—(A) Longitudinal section of a hypoplastic tube from the same molar as fig. 16. Stained hæmatoxylin and eosin. × 70. E.C. = Enamel capsule. Ep. = Degenerating epthelium of the enamel organ. A.D.J. = Amelo-dentinal junction. (B) = Part of the enamel capsule from same specimen. Stained hæmatoxylin and eosin and mounted. × 90. (C) = High-power view of base of the tube inserted into the enamel matrix. × 154. E.M. = Enamel matrix.

anatomical grooves. Controversy has continued for many years concerning the terms fissure and groove (Hodson, 1949*b*). Kronfeld (1935) discusses at some length his view that fissures are normal structures although in the same paper they are defined as defects. It may be that histological technique was not at that time sufficiently advanced to enable Kronfeld to examine developing enamel matrix under high magnification. Recent investigators, however (Brucker, 1944), have taken up Kronfeld's theme. The present writer is of the opinion that clinical assessment of the more important structural defects in the enamel is almost impossible.

(*To be continued.*)

FILMS FOR UNDERGRADUATE INSTRUCTION

BY J. N. ANDERSON, B.D.S.SHEFF.

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FOR many years the medium of the film has been used for teaching technical procedures to large numbers of people. In surgery, the benefits of being able to teach away from the restrictions imposed by theatre procedures were first appreciated in France as early as 1903, and resulted in the production of the first surgical film. To add a touch of humour to this auspicious occasion, the historian records that the camera-operator "fainted" at the completion of the operation. In 1929, the Kodak Medical Film Unit was set up, and led to the making of many good films. This was followed, particularly in the field of anæsthetics, by further films produced by manufacturing concerns. Prior to 1939 only a few dental films existed. These either demonstrated the use of some particular material or apparatus, and were sponsored by the manufac-

turer, or were made by the advocate of some specialised technique in conjunction with a photographer. During the war the increase in the use of teaching films showed itself in dentistry as in other subjects; most of the films at this time were produced by the Services.

Now that cine-photographic equipment and material is more easily obtained, several dental schools are actively engaged in making films for teaching. The interest of the universities in the use of films has increased rapidly, and several universities have their own committees on film instruction. The activities of these committees are co-ordinated throughout the country by the British Universities Film Council, who also arrange courses of instruction in film-production for members of university teaching staffs. The Dental Board has set up an Advisory Committee on visual education which is running a parallel course with the Scientific Film Association in appraising and cataloguing films with the view to the formation of a central film library.

In dentistry the activities of the operator are confined to such a small area that a practical demonstration can be given to only three or four students at one time. This means repetition of demonstrations to cover the present large numbers of students, creates difficulties in the organisation of suitable patients and is time-consuming for the demonstrator. The *teaching* film can show clearly and simply the normal technique and on this foundation clinical experience can be built. Many of the dental films in use to-day show only some specialised method, as did the earlier medical films. These are of interest only to post-graduate audiences, and, though agreeing with the necessity for such films, they will not be considered in this present discussion.

Considerations in Preparing to Make a Film

The most important consideration is: "What is the film to teach?" The optimum running-time of a film is fifteen to twenty minutes. The rate of presentation of facts during this time is high and a longer film should only be shown when the audience is already conversant with the subject. Our techniques must therefore be divided up, and each part made as a self-sufficient unit without repetition of facts already demonstrated but with continuity carefully maintained with the previous sections and those to come after. The subject-matter of these sections must be free from "red-herrings," clever photographic tricks and anything else which does not contribute to the teaching value. The method of using films in this department is to give a lecture on the theory of the subject and to follow this by the film dealing with the practical technique. The student is then ready, with suitable supervision, to try for himself.

A film conveys motion and only moving objects can be usefully portrayed. Static objects are more easily reproduced by slides or film-strips. For example, cine-photography of cases before and after treatment conveys no more than still pictures unless there is some obvious change in degree of movement, or colour of the structures during several separate stages of treatment.

Consideration should also be given to the choice of film-stock to be used. Colour film is essential for any surgical procedures, but in the laboratory monochrome film will give as good results when combined with suitable pigmentation of the materials to be used. The idea still prevails that because a film is in colour it must of necessity be better than one in black and white. This does not hold for professional entertainment films and a strong case can be made for the use of the older type of film in non-surgical procedures, such as the teaching of cavity preparation on phantom-jaws. Colour-film brings with it the necessity for high light-intensity, very accurate exposure, the use of the same "batch" of film-stock and other controls to ensure balanced "colour-rendering."

If the film when finished is to serve several institutions, copies are more easily made from monochrome film, particularly if the camera is loaded with negative stock and a print taken from this for showing. By this method, the "master" film is preserved. Colour copies are by no means as good as the original and one is very tempted to run "masters" for showing. This results in wear and tear on the film, which is the product of so much hard work, and in some circumstances irreplaceable. On the other hand, the subject-matter of a teaching-film is, we hope, constantly progressing and when showing "masters" the writer always hopes that the film will last at least as long as the technique that it teaches.

A recorded commentary on the sound-track of the film is not in the true spirit of university education. The lecturer must alter his remarks to suit various audiences and it must be agreed that a personal voice is of greater teaching value, by the impact of the lecturer's personality upon the students, than the more evenly modulated tones of the professional commentator. At all times during film showing the lecturer must refrain from saying "this is a tooth" or other description of what is obvious on the screen.

The temptation to comment is great but remarks should be kept within the bounds of explanation of minor theoretical detail, or of animation sequences.

Having now decided to make a film, the next step is the " script." The necessity for minutely detailed organisation of all controllable factors must be emphasised – it is here that the picture is really made. Each shot, lasting anything from 2–60 sec. must be planned in as complete detail as possible before the camera is even removed from its case. The shots must be arranged so that the film is continuous in its description and does not jump about, leaving the viewer to catch up at some later time. On the other hand, alterations of distance and angulation of the camera are necessary to avoid monotony.

The small area of activity in dental operations necessitates considerable use of " close-ups," otherwise the field of direct interest is lost in the detail of its surroundings. In many dental operations, particularly those occurring distal to the premolars, access to such a small area is poor. In these circumstances it is difficult to obtain sufficient illumination for colour-film, and the time-restrictions imposed upon the photographer by consideration for the patient make it impossible to carry out consecutive straight filming. This factor is one of the greatest limitations in the production of good dental teaching films, and a decision has to be reached before commencing the film, as to whether the technique can be shown by straight shots or whether animation must be added. Animation is particularly effective in emphasising details which take place too quickly or too slowly for the audience to appreciate the finer points. The site of an incision, the development of structures and the elucidation of a point by graphs are all clearly shown by animated drawing.

Technique

The actual taking of the film has been described as requiring the activities of several people. This arrangement is satisfactory only if each person works intimately as a member of the team, and appreciates the work of all other members. The writer prefers a two-man team. Both discuss the film together from its earliest beginning, and jointly agree on a script. One member then carries out the technique while the other operates camera and lights and reads from the script. It has been shown on many occasions that a good dental film can only be made by having a dental surgeon as camera-operator. A director cannot appreciate precisely the small field which is being photographed, and a lay camera-man does not quickly differentiate between necessities and non-essentials in the activities occurring. The writer would go even further than desiring a dentist-photographer to operate the camera and suggest that the person carrying out the demonstration should have a fair knowledge of photography so that each member of the team appreciates and considers the difficulties of the other.

When the film has been taken, and is returned from the processing laboratory, it contains a mixture of shots out of sequence, and various errors both photographic and technical which have crept into the production. Ruthless discarding of everything but essential pictures is now necessary, and the film must be arranged in a roughly finished continuous length. Any errors are the subject of further scripting and " retakes " and the form of titles and animation is decided upon. In amateur film-production, great satisfaction is achieved by having everything " home-made " ; into the production of titles goes more hard work than an audience appreciates.

When all the parts are completed final editing and joining is carried out, the length of a " shot " being often determined to within a single " frame." Then, and only then, is the film ready to be shown. Too often unedited, untitled films are publicly shown with the remark that " it isn't quite finished yet." This should happen only in an extreme emergency as it is an unworthy end to the effort which has gone before.

Details of the finished film are submitted to the Advisory Committee on Visual Education in Dentistry and to the Scientific Film Association. The latter body will return the film after appraisal and cataloguing to the owner, together with a copy free of charge for his own further use.

From the foregoing remarks it will be appreciated that the production of a teaching-film is no light-hearted undertaking, though it is hoped that this article has not presented the difficulties in too pessimistic a light.

Much as one deplores any tendency to reduce the individuality of dental schools by standardisation of teaching, it would seem that much wasted effort could be saved, by the free discussion of the context of a proposed film among the teachers of the subject concerned, and this would lead to the production of a film whose broad outlines would be acceptable to several schools.

What of the future ? Television appeals by its spontaneity and will be a very useful visual aid when both colour and stereoscopy are added

accomplishments. Its greatest use will perhaps be in giving the student experience of abnormal cases when he has sufficient basic knowledge. The writer believes that the teaching film will remain the most suitable medium for instruction in normal technique, and will become even more valuable if the number of students entering the schools increases.

SHORT COMMUNICATION

MANDIBULAR OSTEOTOMY IN A CASE OF CLEFT PALATE

By T. CRADOCK HENRY, F.D.S., M.R.C.S.Eng., L.R.C.P.Lond.

One of the associated problems of cleft palate surgery, apart from many other types of malocclusion that may result, is a severe mandibular protrusion.

This prognathism appears to be due to an overclosure of the mandible, allowing the chin to swing upwards and forwards and is, as Graber [1] suggests, consequent on an abnormal intermaxillary clearance between the position of physiological rest and occlusion. This in turn is a direct sequel to a lack of growth of the maxilla not only in its lateral direction but also in a forward and downward direction. This type of prognathism, due essentially to maxillary failure, presents in treatment a most difficult problem.

In childhood the results of orthodontic treatment are disappointing and in later years little can be done beyond prosthesis. This will on occasions suffice, especially when there is some degree of molar occlusion and much can be done in simple cases by the provision of an epithelial inlay to bring the upper lip forward. These measures, however, do not always overcome the cosmetic deformity and are not outstanding in improving the occlusal defect. It would seem, therefore, that to obtain a satisfactory result it is first desirable to correct the jaw relationship. One such case forms the subject of this short communication.

G. L., an intelligent youth of 16 years, was operated upon in childhood for a single harelip and cleft palate with a very pleasing result. There was little deformity of the lip beyond a slight loss in vertical height and the alæ nasæ were not distorted. The palate had been adequately repaired and was freely mobile. Anteriorly there was a perforation of no consequence. However, as can be seen from the profile photograph (fig. 1), the cosmetic result was offset by the effect of the protruding jaw and the flattened appearance of the upper lip. Occlusion was virtually non-existent with the maxillary teeth as a whole biting lingually to the mandible. Contact such as existed could only be obtained between $\frac{6}{7}|$ and $|\frac{6}{5}$ (fig. 2). The $\lceil\overline{67}$ had been removed at an early age.

At first it was thought that it would be possible to achieve an acceptable result by an " over-denture," particularly as the upper lip was freely mobile and could be brought forward with ease. However, the discrepancy in the bite was too large to be overcome and the bulk of material that would have been introduced into the anterior part of the mouth would have had a far from pleasing effect.

It was therefore decided to try and obtain an improvement in the jaw relationship before proceeding with a prosthesis. The surgical choice lay between maxillary and mandibular osteotomy. The former was contra-indicated as it is by comparison a

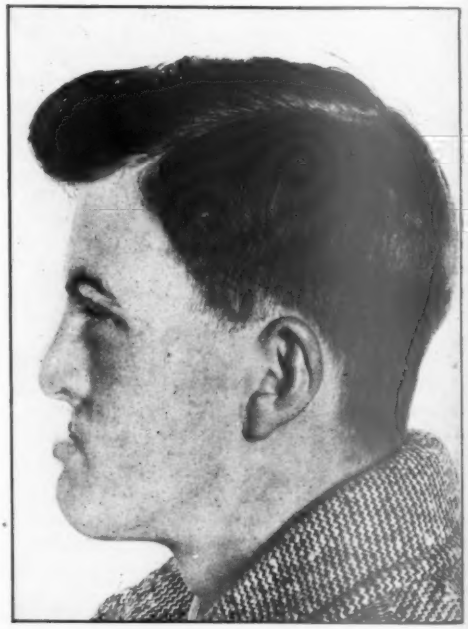

Fig. 1.—Profile view of patient before operation. The jaws in their natural bite.

major procedure, control of the fragments is less positive and stabilisation with union more difficult to obtain. Moreover, in this particular case I was of the opinion that there had been an actual forward translation of the mandible.

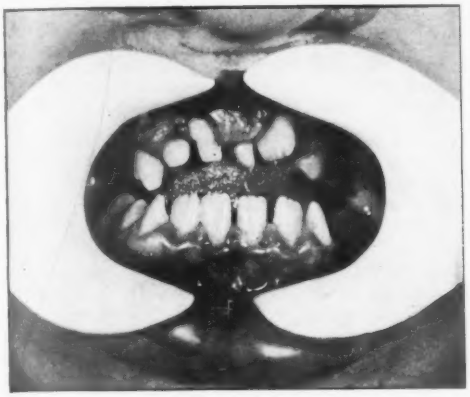

FIG. 2.—Front view of the teeth showing the bite before operation.

Osteotomy of the mandible was decided upon and after some necessary pre-operative treatment that included extractions in the premaxillary region, the fitting of dental cap splints with the appropriate locking mechanism, the operation was performed by Kostecka's method [2].

After section of the ascending rami, the mandible was reduced to the predetermined occlusion shown in fig. 4 and the mandible immobilised to the maxilla.

Convalescence was uneventful and intermaxillary fixation (fig. 5) was released after eighteen weeks. At this stage, as there was clinical and radiological evidence of bony union, the splints were removed and partial upper and lower dentures fitted.

FIG. 3.—Models articulated showing the degree of protrusion and the paucity of the occlusion.

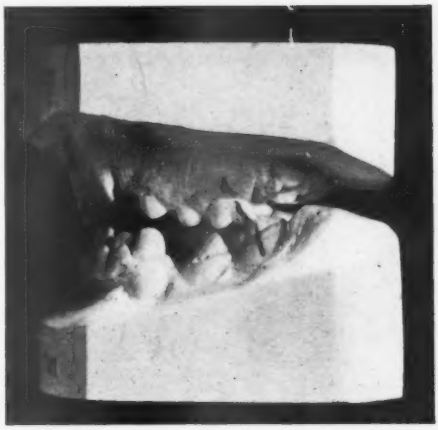

FIG. 4.—Models re-articulated to demonstrate the occlusion that might be obtained by osteotomy of the mandible.

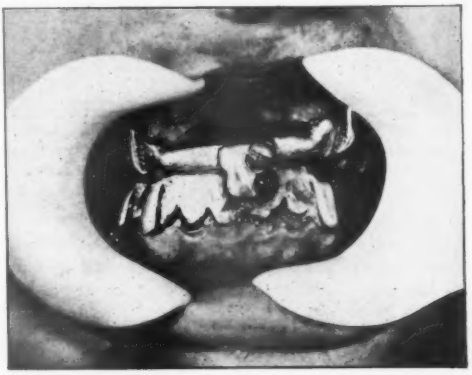

FIG. 5.—Photograph taken after operation, showing cap splints in position and intermaxillary fixation by a precision lock.

FIG. 6.—View of the mouth following the removal of the cap splints and the insertion of dentures.

The final result is shown in figs. 6 and 7 with the patient wearing a prosthesis. His appearance has been improved, he can now appose the lips and for the first time he masticates properly.

FIG. 7.—Profile view of patient wearing upper and lower dentures—eighteen weeks after operation.

SUMMARY

(1) A case illustrating one of the deformities common to cleft palates surgically closed in early life has been described.

(2) A possible method of treatment, where orthodontic treatment or prosthesis alone are insufficient, has been explored and mandibular osteotomy performed.

Grateful acknowledgment is made to Mr. Derek Martin for his excellent photographs.

REFERENCES

[1] GRABER, T. M. (1949) *Quart. Bull. Northw. Univ. med. Sch., Chicago*, **23**, 153.
[2] HENRY, C. BOWDLER (1946) *Brit. dent. J.*, **81**, 123.

Orthodontic Notes

Diagnostic Implications of the Sequence of Eruption

PREMATURE loss of deciduous molars, especially the second ones, is frequently followed by medial tipping of their corresponding permanent molars. The sequence of eruption of 3, 4 and 5 largely determines which tooth is out of line. The first molar may tip medially very rapidly. The following may influence this: (1) Medial contact support of teeth between the first molars and incisors. (2) Occlusion of first molars including the relationship between cusps, fossæ and grooves. (3) Axial inclination of the first molars. (4) Eruption sequence of the second molar relative to canines and bicuspids.

Between 9 and 11 years of age, as each deciduous tooth is lost, the succeeding permanent tooth erupts, promptly offsetting any tendency of the first molar to tip medially. Usually the canine and bicuspids erupt before the second molars. If, however, the second molar erupts before or during the period of canine and bicuspid eruption, tipping is more likely to occur. Three cases are reported, in the first, that of a boy aged 10, $\overline{e}|$ was lost more than a year previously; there was no loss of space by comparison of $\overline{62}|$ space with $|\overline{26}$ space, but two months later $\overline{6}|$ had tilted 2 mm. but as there was still sufficient space for $\overline{54}|$, no treatment was undertaken. Five months later when $\overline{74}|$ were erupting there was further medial movement of $\overline{6}|$. In the second case $|\overline{6}$ tipped though the period when it was unsupported medially was very short; in the first week it moved medially 1 mm. so a retainer was placed on $|\overline{cd}$. The latter were shed in six months when $|\overline{5}$ was erupting but within two weeks $|\overline{6}$ had moved another millimetre, so a lingual arch retainer was placed. Three months later $|\overline{347}$ were erupting, thus, for ten months after the loss of $|\overline{e}$, $|\overline{6}$ was supported, except for three weeks, but it tipped medially more than 2 mm. in this period; it may be significant that $|\overline{7}$ was erupting. (The writer does not refer to any allowance having been made in this case for the normal medial movement of $|\overline{6}$ when $|\overline{e}$ is lost.)

In another case, in which the lower cusp is a very good one, $\overline{543}|\overline{345}$ erupted well before $\overline{7}|\overline{7}$ which made little progress towards eruption during 22 months, $\overline{6}|$ did not move medially, but $|\overline{6}$ moved 1 mm. $\overline{3}\,\overline{4}\,\overline{5}$ erupted in this order—which seems the most favourable sequence. There was no medial inclination of any of the four first molars and it is suggested this may be a factor in the stability of $\overline{6}|\overline{6}$. This case also supports the view that the eruption order $\overline{3}\,\overline{4}\,\overline{5}$ preceded by loss of their predecessors immediately, and in the case of loss of $\overline{c}$ and $\overline{d}$ by loss of $\overline{d}$ and $\overline{e}$ respectively, permits $\overline{3}$ and $\overline{4}$ to encroach slightly on the space distal to their predecessors; this sequence is most likely to result when there is no medial movement of $\overline{6}$ until after $\overline{5}$ erupts, and this seems more likely to occur when $\overline{7}$ is relatively late in erupting.—SPEIDEL, THOMAS D. (1949) *Journ. Amer. Dent. Assn.*, **38**, 5.

Minimising the Need for Orthodontic Therapy

A GIRL aged 8 years 7 months had a Class I malocclusion, $\underline{2}|\underline{2}$ being somewhat labial to $\underline{1}|\underline{1}$ and rotated: appliances were used only on the lower arch and at 11 years the teeth of both arches were in excellent alignment and occlusion. It was considered that myofunctional therapy would develop the upper dental arch while the lower appliance was in operation. The child was instructed to exercise the muscles of mastication and deglutition before meals with the teeth in centric occlusion but not clenched, the muscles of mastication were slowly and quietly flexed seven times. The patient was instructed that all food that required chewing was to be masticated until the bolus could be readily swallowed, and to sip her drinks not to pour them down. This method of eating and drinking causes the muscular force of the tongue to work beneficially on all areas of the dental arches and strengthens the muscles of deglutition.—WILLETT, R. C. (1949) *Amer. J. Orthodont.*, **35**, 913.

BRITISH DENTAL JOURNAL
JULY 7, 1950

DISCIPLINE CASES

THE discipline cases which were considered by the Dental Board of the United Kingdom at their recent session supply a striking illustration of some of the changes which have followed on the enactment of the National Health Service Acts. Five of the six cases before the Board had been reported to that body by the Ministry of Health and arose directly out of charges which had already been investigated by either a dental services committee, the Tribunal or in one case by a Court of Criminal Jurisdiction. This apparent duplication of disciplinary procedure may well be puzzling to the average layman ; indeed, there is evidence that Members of Parliament, themselves, do not always appreciate the nature of the disciplinary functions of professional bodies such as the General Medical Council and the Dental Board. In his address to the last session of the Board, the Chairman of the Board was at pains to stress the essential difference between the issues which fall to be decided by dental service committees or the Tribunal on the one hand and the Board on the other. The concern of the former is to decide whether or no a practitioner has committed a breach of the regulations governing the General Dental Service and, if so, what penalty, if any, should be imposed upon him. Incidentally, the power of Executive Councils to recommend that a sum of money should be withheld from the remuneration of a practitioner by way of a fine—although it is a new feature in dental practice—is, in effect, an extension of a procedure which has operated for many years in relation to medical practice under the old National Health Insurance Acts.

On the other hand, the issue to be decided by the Dental Board is not whether the practitioner has given unsatisfactory treatment or otherwise infringed any of the regulations, but has his conduct in the particular case or cases been such as to render him unfit to remain a member of the profession. The Board are not, and cannot be, concerned with any question as to the professional competence of a practitioner—the fact that his name has been entered on the Register is conclusive in that respect. A decision that the name of a practitioner should be erased from the Register does impose a very severe penalty on him, but it is not punitive in intention, the sole object of the Board being to protect the public from the risk of being treated by practitioners who cannot be trusted to maintain a proper standard of professional ethics. There is a tendency in some quarters to regard the traditional codes of professional conduct as being devised solely in the interests of members of the professions concerned, whereas the truth of the matter is that in this, as in all other matters that affect the relations of the professions to the public, there is a community of interest, and any departure from the highest standards of professional conduct cannot but react to the detriment of both parties. That is the fundamental reason why every organised profession provides itself with machinery which will enable it to take disciplinary measures against those of its members who act in a manner " infamous or disgraceful in a professional respect."

It will be noted with regret by all who have the honour of the dental profession at heart that, on account of the unwillingness of a number of witnesses who had given evidence at hearings under the National Health Service to repeat their evidence before the Dental Board, a number of cases in which the Discipline Committee might have thought it proper to call a practitioner to appear before the Board, could not proceed to that stage. The result is either that a practitioner is deprived of an opportunity of clearing himself from a possibly unfounded charge or that the profession is estopped from exercising its disciplinary powers to the full. This is not a new difficulty and, under the Medical Bill which is at present before Parliament, the Discipline Committee of the General Medical Council are to be given power to subpœna witnesses. It may be taken for granted that any Bill to amend the Dentists Acts will contain a similar provision.

It is possibly significant that in a very large proportion of the cases which came before the Board, one of the charges against the practitioner was that he had demanded and accepted fees for dentures from patients whom he had under-

taken to treat under the Health Service. Towards the end of the war, some dentists habitually "contracted-out" in respect of fees payable for dentures under the old Dental Benefit Regulations, and there is little doubt that the comparative immunity with which this irregular practice was carried on has led some dentists to ignore the obligations consequent upon their acceptance of service under the Health Acts. A dentist may quite properly refuse to undertake cases which include the provision of dentures if he thinks the fee payable for them under the Regulations is inadequate. But, having accepted a patient for treatment on the terms laid down, he is under an obligation strictly to observe those conditions. Any departure from them is contrary not only to the Regulations but to every proper standard of professional conduct. It is clear from the proceedings of the Board that they take a grave view with regard to this offence.

The number of dentists concerned in the cases considered by the Board constitute only a minute fraction of the profession, but unfortunately the misdeeds of this small number, and the publicity accorded to them by the Press, bring an undeserved measure of discredit on the profession as a whole, the great majority of whom are loyally endeavouring to carry out their obligations to their patients to the full under very difficult conditions.

NOTES AND COMMENTS

Proposed General Dental Services Committee

A RESOLUTION approving the formation of a General Dental Services Committee was adopted with but few dissenting votes at the conference between members of the Council of the British Dental Association and representatives of Local Dental Committees, held at the British Medical Association House on Saturday, June 24. Following on the adoption of this resolution the conference discussed the provisional constitution of the committee which had been placed before the conference by the Council. Some amendments were introduced into the constitution and it was agreed that the proposals as amended should be reported to the Representative Board and to Local Dental Committees, it being understood that the conference was a preliminary one and that those taking part in it were not authorised to make final decisions or to bind the bodies they represent to accept the recommendations of the conference.

The Medical Bill

THE Medical Bill has passed through all the stages in the House of Lords and was given a Second Reading in the House of Commons on June 27. Some amendments were introduced into the Bill during its passage through the Lords, the number of elected members of the General Medical Council was still further increased to eleven and it is specifically provided that one of these must be a Welshman. Commenting on this, Mr. Bevan said he considered this provision was a work of supererogation because he was certain that a Welshman would have found his way there anyway, since so many are distinguished members of the profession. The Bill provides that a doctor whose name is erased from the Register will have the right to appeal to the Judicial Committee of the Privy Council—not the High Court—either on law or fact or against sentence. The Bill also provides an increase in the fee for original registration from £5, at which figure it was paid in 1858, to £11 11s.

The Dentists' and General Mutual Benefit Society

THE Dentists' and General Mutual Benefit Society was founded in 1927 by the Incorporated Dental Society and is the second youngest Holloway Society in being. Throughout its existence the Society has been closely associated with the Incorporated Dental Society and its offices have been with the I.D.S., first at 12, Tavistock Square and later at 30 Tavistock Square. The head office is still at the latter address. By the end of the first year, the Society had elected to membership 85 members and for three years included only dentists in its membership, the majority of which were members of the I.D.S., now amalgamated with the British Dental Association. The Dentists' and General Mutual Benefit Society has steadily grown, reaching its majority two years ago with a record of excellence, proved by the rate of annual apportionment credited to members' accumulated funds which for the last eight years has been at the rate of £1 8s. per share. Sickness benefit can be obtained up to £8 per week and the Society has paid in sickness benefit a total of over £16,000. The contract with the Society is a permanent one, a valuable feature not possessed by annual sickness policies, which the companies may decline to renew or only to accept at an increased premium if owing to lengthy illness the policy holder has needed to make claims upon the company. Accumulation of savings is secure, the Society being in a strong position with accumulated funds amounting to nearly £100,000. Members,

accumulations earn interest at 4 per cent; to illustrate the value of capital accumulations during membership, it is sufficient to state that any person joining at the minimum age of 16 will withdraw at age 65 a sum amounting to more than double his contributions during membership, in addition to being covered for sickness benefit throughout this period.

The Nuffield Foundation

THE Fifth Report of the Nuffield Foundation for the year ending March 31, 1950, records the extension of the Foundation's activities into new and promising fields as well as the continuation of projects already commenced. An innovation is that grants may now be made in support of research to Dominion universities and similar institutions within the British Commonwealth. These grants will be very limited in amount and carefully selected, and the first made has been to endow a research professorship of mechanical engineering in New South Wales. Grants continuing from earlier policies include substantial support for medical research projects, in natural and social sciences, and in particular in connection with rheumatism with special reference to cortisone and A.C.T.H. The new programme of grants reflects the policy of the second five-year programme to devote a major part of its resources to fundamental research especially in biology and sociology. Fellowships and scholarships including those in dentistry continue as before or with slight modifications and fellowships are now offered to the new Dominions of India, Pakistan and Ceylon. Six new dental fellowships and one dental scholarship are recorded. For information on the many other activities of the Foundation readers should consult the Report. It contains ample evidence of the progressive and courageous guidance which the Foundation has enjoyed.

Industrial Dental Care

UNDER this title the Division of Industrial Hygiene of the Public Health Service of the United States have issued a comprehensive bibliography of articles dealing with dentistry in industry. This should prove very useful to those who are concerned to ensure that adequate dental care is available to the workers in particular industries. The introduction of the National Health Service has had the effect of making the conditions with respect to this particular problem different in this country from those which obtain elsewhere. While, therefore, the list will be more useful to dentists in other countries many in this country will find something of interest to them in the 108 articles listed.

Fifty Years Ago

From the "Journal of the British Dental Association," July 16, 1900.

We have received the following intimation from the Committee of the Paris Dental Congress : A certain number of colleagues in the country and abroad have informed us of their apprehensions with regard to the expense of a stay in Paris during the Exhibition and for the Congress. We think it as well to reassure them on this matter. . . . If, . . . the hotels have raised their prices to a certain degree, there remains the alternative of applying to us as soon as possible, in order to find rooms from 3½ or 4 francs. We will forward such applications to the various Reception Committees. To sum up, the traveller who wishes to live in Paris comfortably but simply, can, in our opinion, limit his expenses to 9 or 10 francs per day.

LETTERS TO THE EDITOR

FROM MR. G. F. CALE-MATTHEWS

SIR,—It is a great disappointment that advancing years make it impossible for me to take an active part in the deliberations of the Annual Meeting to be held in Birmingham next month.

A keen member of my Association and an active practising member of my profession for very many years, I look back upon the part I played in the formation of the Dentists' Provident Society as the thing that will remain as my most useful contribution to those who follow on.

From a small beginning to see in one's own time funds accumulated to approximately £1,000,000 is an achievement that affords me great satisfaction, and I commend the Society to all those who are not yet contributors to it and particularly to our younger members.

B4, Kenilworth Court, Yours faithfully,
Edgbaston, G. F. CALE-MATTHEWS.
Birmingham.

DR. WILLIAM GUY

SIR,—May I, for the sake of historical accuracy, draw attention to an error appearing in your Obituary of Dr. William Guy in the Journal of June 16: His mother (Patricia Maule Millar) was not, as was stated, a sister of Dr. John Smith, but a full cousin of Dr. John Smith's wife (Elizabeth Marjorie Peters).

14, *Buckingham Terrace,* Yours faithfully,
Glasgow, W.2. J. MENZIES CAMPBELL.

THE PILTDOWN SKULL

SIR,—I hesitate to enter a field in which Mr. A. T. Marston is so well known an authority, but one point concerning the Piltdown skull does occur to me.

If the mandible does not belong to the skull, then I believe I am right in saying that it represents a new species of ape. Thus the Piltdown discovery shows the coincidence of the finding of a new species of man and a new species of ape.

The later (1915) finds, two miles away, of a lower left molar tooth with skull fragments repeat this coincidence, if we assume that the tooth is similar to those in the mandibular fragment. Sir A. Keith (Antiquity of Man) appeared to regard the tooth in that light.

Thus the initial strange coincidence is enhanced by its repetition two miles away. Against the improbability of the double coincidence, we have the apparent incompatibility of the simian mandible with the glenoid fossa. Which is the least unlikely alternative ?

Could not the specimens belong to the same species ? The fluorine test does not exactly disprove this possibility, whatever the age relative to the Villafranchian fauna.

Incidentally, I notice that Sir A. Keith (Antiquity of Man (1925) Vol. II, 493) describes the finding of the occipital fragment in the *same* stratum as the mandible. This was second-hand information, and may have been in error.

30, *Hurstview Road*, *Croydon, Surrey.* Yours faithfully, R. J. HART.

SIR,—I hesitate to question the authority of one whose knowledge of the material is far greater than mine, but on the interpretation of a chemical test as applied to this material I feel more qualified to criticise Mr. A. T. Marston's observations on the results of the fluorine test applied to the Swanscombe and Piltdown skulls. Mr. Marston when considering the import of the fluorine values for the Piltdown remains would compare the fluorine content of these bones with that of bones from the Swanscombe and Galley Hill sites. Such a comparison, according to Dr. Oakley, whose article on this subject (*Nature* 165, 379 (1950)) your correspondent recently reviewed, is not justified since the localities concerned are widely separated and so the conditions for fluorine uptake by the bones may be entirely different in each case. Hence, one cannot argue that because the Upper Pleistocene bones from Swanscombe have approximately the same fluorine content as certain of those from Piltdown, the latter should be attributed to the same age. This will only be the case if the conditions for fluorine uptake have been identical in both localities and Mr. Marston in his article does not state that this has been so. Similarly, it is invalid to imply that the fluorine content of Holocene specimens from Galley Hill can be used to strengthen the case that specimens from Piltdown of similar fluorine content belong to the Holocene age.

Based on the other evidence, Mr. Marston's conclusions may well be correct, but I do not consider that he can disregard lightly Dr. Oakley's warning that the fluorine dating method for bones cannot be used to compare bones from widely separated localities unless he can show that the conditions for fluorine uptake have been identical in the localities concerned.

Department of Zoology, *King's College*, *University of London*, *Strand, W.C.2.* Yours faithfully, P. H. STAPLE, *Nuffield Dental Research Fellow.*

STERILISING DENTINE POWDER

SIR,—Messrs. Castagnola and Orlay mention in their excellent article the difficulty of sterilising dentine powder for use in pulp-capping.

Between 1940 and 1942 I carried out twelve clinical experiments using dentine powder for pulp-capping following partial pulpectomy with complete success.

The method used to obtain sterile dentine is simple and effective. Sound caries-free teeth extracted for orthodontic purposes were used. The enamel was removed, and the dentine ground to powder with sterile burs into sterile petri dishes. These were autoclaved, and the sterile dentine powder placed into small glass bulbs with long necks, made by blowing thin glass tubing. These in their turn were autoclaved, and the ends of the tubes heated, drawn and sealed. In this way a supply of sterile dentine powder can be obtained which can be kept indefinitely.

When used, the powder was mixed with a drop of eugenol—forming a thick granular paste, which was placed directly in the pulp chamber, covered with a thin zinc oxide-eugenol paste, and finally sealed with cement.

I would like to stress the importance of this form of pulp treatment in the field of orthodontics. One is often confronted with first permanent molars so carious, that caries removal will mean pulp exposure. Because of this all too often these teeth are lost, making treatment difficult and prognosis more uncertain. Partial pulpectomy can in many cases restore these teeth to normal functional units.

The ever-increasing fractured maxillary incisors present another case for the use of this treatment. When the pulp cornua is exposed, partial pulpectomy will in many cases maintain a vital tooth which will be able to complete its growth and development, whereas other treatments often result in pulp degeneration with loss of the tooth. I have seen six cases of this within the last year.

67, *Rodney Street*, *Liverpool*, 1. Yours faithfully, JOSEPH ANGELMAN.

EARLIER ERUPTION OF TEETH

SIR,—Perhaps the answer to Mr. Tran's enquiry about the earlier eruption of deciduous teeth today may be found in the reduced incidence of rickets compared with twenty years ago. I have no figures as to this but I understand that it is so, and in consequence fewer children will be experiencing retarded eruption.

If Mr. Tran requires some figures for present day eruption times may I refer him to my article in the *Brit. dent. J.* (1945), **79**, 1.

Havercroft, *Lamplugh*, *Workington.* Yours faithfully, G. B. HOPKIN.

SIR,—While realising that " one swallow does not make a summer " I, too, have noticed that some young patients are erupting certain teeth somewhat early. Like Mr. Tran I have not had much opportunity of observing the times of eruption of the deciduous teeth, but, in the summer of 1941, after vainly endeavouring to save the $\overline{|d}$ of a girl of 8 years, the patient of an absent colleague, I was amazed upon extracting it to find the crown of the $\overline{|4}$ almost protruding. Thereafter this child shed all deciduous molars in rapid succession, but unfortunately the parents were obliged to move from the district owing to war exigencies, and I was unable to observe the complete eruption of the premolars, and the time taken for this process.

Having had my attention drawn to this phenomenon, I was careful to ask the exact age of all children who were

erupting premolars, and was astonished to find that quite half of my young patients, girls more particularly, were doing so between the ages of 8 and 9 years. The same early eruption did not seem to occur with regard to other teeth, although I recollect one child of 9 years, with the physical development of a girl of 12, for whom I had had to extract all b's, erupting her premolars and second molars all together.

I must admit that I have not kept notes of these observations, but these incidents stand out in my memory. It would, however, be interesting to hear from any workers among children who may have been more scientifically observant, and kept statistics.

Lewesdon,
Lyme Regis,
Dorset.

Yours faithfully,
GRANT H. PHILLIPS.

Reviews and Abstracts

DENTAL ANATOMY. THE FORM AND FUNCTION OF THE PERMANENT TEETH. By Robert C. Zeisz, D.D.S., F.A.C.D., F.I.C.D. Formerly Associate Clinical Professor of Crown and Bridge Prosthesis, Chairman of the Divisions of Tooth Morphology and Applied Dental Anatomy, University of California ; and **THE FORM AND FUNCTION OF THE DECIDUOUS TEETH.** By James Nuckolls, D.D.S., F.A.C.D. Professor of Operative Dentistry, Chairman of the Division of Preclinical Sciences, Chairman of the Section of Oral Pathology, University of California. London : Henry Kimpton. 1949. Pp. 486. Price £5.

This excellently produced book covers in great detail, the macroscopic anatomy of the crowns, roots and pulp chambers of the permanent and deciduous teeth, with their commoner variations. The lay-out is first class, with a clear diagrammatic outline of each tooth surface, facing a pictorial reproduction of the tooth. These reproductions are works of art, in fact, almost too perfect. The arrangement of illustrations with regard to the text is good, and makes reading, while referring to these illustrations, easy.

Apart from its value as a scientific treatise, the main functions of such a book should be to aid a dental surgeon in his restorative and other work upon the teeth. With regard to surface anatomy, this aim is definitely achieved, but a diagrammatic illustration of the floors of the pulp chambers in molars and premolars, with points of access also indicated, would also have been of value.

Pages 1 to 24, on the general structure of the teeth and parodontal tissues, could well be omitted, as they are no more than very brief summaries of no real value. In giving the occlusion of the upper with the lower teeth, their actual relationships to each other are omitted, and no mention is made of the curve of Spee and its relationship to the Frankfurt-mandibular angle and the condylar path. Chapter 9, dealing with the relationship of the deciduous teeth, is very sketchy, and might well have been omitted, as to deal fully with this subject, including the changes which occur during development, would require a great deal of space.

These few points, picked out from the preliminary and concluding passages of the book, in no way detract from the value of its main subject matter.

PENICILLIN. Second Edition. Under the General Editorship of Sir Alexander Fleming, M.B., B.S., F.R.C.P., F.R.C.S., F.R.S. Professor Emeritus of Bacteriology, University of London ; Principal, Wright-Fleming Institute of Microbiology, St. Mary's Hospital Medical School, London. Butterworth and Co. 1950. Pp. 491. Price 30s.

This excellent book, now in its second edition, is an exhaustive treatise on the practical application of penicillin, produced under the general editorship of its discoverer.

It is an attractively produced volume, clearly printed and containing a number of good illustrations. The text is divided into two parts, General and Clinical. The first, largely technical, deals with discovery of penicillin, its manufacture, pharmacology, bacteriological control of therapy and methods of administration contributed by various authors. The second describes, in detail, its clinical uses under a number of headings, each section written by a separate contributor.

The size of the book has been increased by more than a hundred pages, this increase being mainly due to the inclusion of two new chapters, one on penicillin sensitivity and the other on the allied antibiotic, streptomycin. An appendix has also been added giving a short résumé on the two most recently discovered antibiotics, chloromycetin and aureomycin.

In the second part of the book a chapter has been included on dental and oral infections contributed by Dr. Wilfred Fish. This is a clear account of the use of penicillin for infections of the mouth and jaws, coupled with a short description of the pathology and bacteriology of the conditions. Prominence is rightly given to the importance of other forms of treatment both during and after penicillin therapy, the reader is reminded that penicillin treatment is seldom a sound alternative to surgery. The use of penicillin applied locally in the treatment of infected root canals might have been mentioned, this is a small point, but it is a useful method of reaching the periapical tissues, of particular value to the dental surgeon when the facilities for intramuscular injection are not available.

A chapter is also included on penicillin in animal diseases. The index is clear and adequate and references are conveniently placed at the end of each chapter.

Although this book is bound to have only a limited appeal to the dental surgeon as much of its material is outside the scope of his work, there is no doubt it would well repay reading. The success to be obtained from the use of penicillin depends so much on knowing exactly what it can and cannot do, and a thorough grasp of the methods and technique of administration is of the utmost value.

The Effect of Topical Application of Fluorides on Dental Caries in Young Adults.—Because it has not yet been demonstrated that topical applications of sodium fluoride reduce caries in adults, it has commonly been assumed that the applications are effective only in children. Observation was kept on 139 students of ages 18 to 40 years in whose mouths two quadrants had been treated with 1 per cent sodium fluoride or 0·06 per cent lead fluoride every 3 months. The other quadrants were kept as controls. The applications were made in the usual way after polishing the teeth with pumice and water and drying them scrupulously. Examinations were made radiographically. At the end of approximately fourteen months the quadrants treated with sodium fluoride showed 56·6 per cent and the quadrants treated with lead fluoride 38·5 per cent less new carious surfaces than the untreated control quadrants.—KLINKENBERG, E., and BIBBY, B. G. (1950) *J. dent. Res.*, **29**, 4.

Dental Cavities in the Golden Hamster.—Many investigators have described cavities in the teeth of hamsters receiving rations rich in carbohydrate and have assumed that these cavities are produced by a process analogous to that of human caries. King has previously shown that hamsters given cereals develop, in addition to a form of parodontal disease, cavities in the exposed cementum and dentine of the root. These cavities eventually extend into the pulp and lead to breakdown of the coronal enamel which results in cavities similar to those of caries but which are essentially secondary to the gingival disturbance. In the present experiment the cereals were replaced by refined or raw cane sugar. 88 animals which during weaning had been fed on a diet including cereals were used. After a period the teeth were studied for cavities radiographically, by examination with a fine broach with the aid of a dissecting microscope, and histologically. As in the case of parodontal disease, which is more marked in the upper jaw, there was a higher incidence of cavities in the upper jaw and in nearly all cases the initial lesion was in the cementum, whence it progressed into the dentine and often into the pulp, with secondary involvement of the coronal enamel. In no instance were primary coronal cavities established. The most severe lesions were in the neighbourhood of the openings of the salivary ducts. These results suggest that extreme caution should be exercised in interpreting cavities in the teeth of hamsters as analogous to human caries of enamel.—KING, J. D. (1950) *Brit. med. J.*, April 15, 876.

Ammonia and Dental Caries.—Kessel, R. G., *et al.* (1946, *J. Amer. dent. Ass.*, **33**, 695), stated that saliva from caries-free individuals, when incubated for eight days in a beef broth medium, produced a higher concentration of ammonia (estimated by the " Permutit " method) than did saliva similarly treated from caries-susceptible subjects. They also stated that high concentrations of alkaline ammonium salts or Seitz filtrates of incubated caries-free saliva were lethal to the Hadley strain of *Lactobacillus acidophilus* and concluded that high ammonia production in the dental plaque might be responsible for the natural freedom from caries which a few individuals exhibit. The experiments of Kessel *et al.* were repeated under as nearly possible identical conditions. The ammonia concentrations produced during an incubation of approximately one week of saliva with ten times the volume of beef broth were estimated by Conway's method but no difference was found between the behaviour of salivas from subjects with different rates of caries. A comparison was then made of the inhibitory effects of certain ammonium salts with those of the corresponding sodium salts on lactate production (estimated by the method of Friedmann and Graeser) by saliva and glucose mixtures. The ammonium and sodium salts were found to act in the same way in each case: acetate caused no inhibition, dibasic phosphate caused weak inhibition at the beginning of the experiment, and bicarbonate caused strong inhibition. From this it was concluded that the inhibitory effect was due to the maintenance of the pH of the final mixture of saliva and salt above 7·8; no evidence was found that the ammonium ion had a specific inhibitory effect. The effect of urea and dibasic ammonium phosphate on salivary lactate production was also investigated. It was confirmed that mixtures of 3 per cent urea and 5 per cent dibasic ammonium phosphate were strongly inhibitory to salivary lactate production but, again, no inhibitory action could be attributed to the ammonium ion. However, experiment showed that both 5 per cent dibasic ammonium phosphate and dibasic sodium phosphate were powerful inhibitors of salivary urease. Since ammonium phosphate by virtue of its low pH is not an effective inhibitor of lactate production, and since the addition of a mixture of dibasic ammonium phosphate and urea to saliva does not lead to production of highly alkaline salts from urea because of the inhibition of the urease, it was concluded that urea itself was the active constituent of the mixture. This was confirmed by showing that pure cultures of *Lactobacillus acidophilus* (which contained no urease) were completely inhibited in glucose broth containing 2 per cent urea. It has long been known that high concentrations of urea inhibit urease and it is suggested that with such mixtures as 22·5 per cent urea and 5 per cent dibasic ammonium phosphate (contained in certain commercial dentifrices) both urease and acid producing mechanisms will be inhibited by the high urea concentration. Ammonium phosphate merely serves as a buffer and an additional safeguard against the breakdown of urea. While not doubting that such mixtures could reduce acid production and maintain a high pH in the oral cavity for some time after use, the authors do not believe that ammonium salts play the part which Kessel *et al.* have stated. While it is a controversial point as to whether the initial stage of the carious process is one of acid decalcification or of proteolytic dissolution, it is possible that high concentrations of urea might also interfere with proteolytic bacteria; tests on this point, however, must await the identification of the organisms concerned.—JENKINS, G. N., WRIGHT, D. E., and MILLER, T. K. (1950) *Nature, Lond.*, **165**, 606.

A Clinical Study of Amalgam Failures.—The manufacture of dental alloys nowadays is mostly to the specification of the Bureau of Standards. The causes of failure of amalgam fillings must be sought elsewhere. In this study, the clinical method was adopted in the examination of 1,521 amalgam restorations. The most common reason for failure was recurrent caries, with 53·5 per cent of the total number of fillings observed.

This could be traced to improper cavity preparation, and to failure of the filling material itself. Fracture was next, affecting 26·2 per cent of the fillings examined. The main cause for this was faulty manipulation of the material which can be listed as: (1) improper mercury-alloy ratio, (2) under-trituration, and (3) improper condensation. Relatively few fractures were considered to be due to faulty cavity preparation. Where dimensional changes were regarded as reasons for failure, excessive expansion accounted for 16·1 per cent, and contraction for only 2·5 per cent of the total. The expansion was due most probably to contamination of the amalgam from moisture either during the process of trituration or condensation. Pulp and periodontal involvement were caused by only 1·2 per cent of the total failures examined. Throughout this clinical approach to the problem of failure of amalgam fillings, the results of other workers using different methods of study were confirmed to a surprising degree.—HEALEY, H. J., and PHILLIPS, R. W. (1949) *J. dent Res.*, **28**, 439.

THE HEALTH SERVICE

THE CUT IN THE SCALE

THE following letter has been sent by the London Local Dental Committee to the Ministry of Health :—

At a meeting of the London Local Dental Committee held on Wednesday, May 11th, 1950, it was resolved that a Memorandum be sent to the Minister protesting against the cut of 10 per cent imposed in May, in the remuneration of dentists providing General Dental Services under the National Health Service Act, and deploring the breakdown of the Priority Dental Services within the London Health Area.

With regard to the cut in remuneration, the Committee strongly resent the unilateral action of the Minister, which will not, in the opinion of the Committee, have the desired result of reducing the cost of the service.

The overall cut is quite unjust in that it bears very hardly on the conscientious dentist, while the few who may have abused the service will remain undeterred.

Much has been reported in the National Press regarding the alleged high earnings of dentists, which is grossly misleading and detrimental to the dental profession, while Parliamentary utterances have shown a similar trend.

In striking contrast are the actual statistics obtaining in London. The published records reveal that there are 1,090 dentists on the London Executive Council list, and that for the year ending 31.3.50 the gross remuneration amounted to £3,824,556, an average of £3,509 per dentist. (Net income £1,684.)

For the purposes of the Ministry, it was estimated that 52 per cent of the gross fees represented the normal practice expenses, and 48 per cent the net income.

In actual fact, for many practitioners, the expense ratio is 60 per cent and higher, so that the well-equipped practitioner is already at considerable financial disadvantage.

The latest arbitrary cut therefore inflicts the heavy reduction of a least one quarter of the net income of the type of practitioner that the Minister should be most anxious to encourage (the well equipped, conscientious dentist).

It must further be pointed out that the average gross income obtaining in London falls short of that which the Spens Committee considered reasonable for the skilful dentist working 33 chairside hours per week, and that the majority of dentists, as a result of the heavy demand for free treatment, are working far longer hours.

That the cost of the General Dental Services is so much higher than was originally estimated is not a matter for which the dental profession should be reproached or penalised. It is the sole responsibility of the Ministry who inaugurated the full free service for all.

Rather should the London dentists be praised for endeavouring to meet the demand for free treatment from a population of 3,500,000 with so few as 1,090 practitioners to carry it out.

With regard to the priority classes whose dental treatment is the joint responsibility of the Local Authority and the Board of Education, the Committee deplore the almost complete breakdown of these services.

Individual dentists are doing their utmost to treat the urgent cases, but this does not touch the fringe of the problem, which should be preventive treatment.

The Local Authority and the Board of Education have not faced up to their responsibilities and have failed to provide proper services.

The reason for their failure is not far to seek. They have been quite unwilling to offer the remuneration and conditions of service which would attract the type of practitioner essential to such service.

QUESTIONS IN PARLIAMENT

Medical and Dental House Officers (Pay).—Mr. G. Hutchinson (*Ilford North*) asked the Minister whether he was aware that the rates of pay for qualified house officers, medical and dental, in the hospital service were substantially below the rates paid to clerical division clerks and whether, in the circumstances, he proposed to review these rates of pay so as to bring them more into line with professional status and qualifications.

In a written reply the Minister of Health said that these matters were for the appropriate negotiating machinery.

Hospital Medical Officers.—Surgeon Lieut.-Commander Bennett (Gosport and Fareham) asked the Minister of Health to what extent medical officers graded as senior hospital medical officer were thereby rendered ineligible for promotion to consultant status.

The Minister of Health replied " Not at all."

Public Dental Service

MANCHESTER EDUCATION COMMITTEE

SCHOOL HEALTH SERVICE ANNUAL REPORT FOR 1948

DURING 1948, as in former years, Manchester's School Dental Service was seriously handicapped by shortage of dental staff and the Senior Dental Officer (Mr. A. G. Batten) has justifiably emphasised this shortage and its implications in his annual report.

An indication of the extent of the staff shortage is given by the fact that although the school population was 98,530 it was found possible to inspect the teeth of only 51,239 of these children during the year. No less then 9,517 children attended at the school dental clinics seeking relief from pain or because they had been specially referred as needing emergency treatment.

Of the defective permanent teeth treated by filling or extraction, 12,967 were filled and 5,948 were extracted, which means that the extent of the decay in the permanent teeth of Manchester school children during 1948 was such that approximately one out of every three decayed permanent teeth had to be extracted. Such a position is a direct result of serious understaffing and an improvement cannot be expected until more favourable staffing conditions are introduced.

Justifiable sympathy must be felt with Mr. Batten and his assistant colleagues in respect of the magnitude of the dental problem with which they were confronted during 1948. The report admits that many children who visited the clinics received incomplete treatment but what other course could such a small staff adopt when confronted by such a large school population? There remains, however, the very serious and potent fact that the many thousands of slightly decayed permanent teeth which could not be treated during 1948 will rapidly progress to the state of being unsavable and so a continued high ratio of extractions must be expected in Manchester during 1949.

Dental News

ROYAL COLLEGE OF SURGEONS OF ENGLAND

At a meeting of the Council of the Royal College of Surgeons held on June 8, Professor R. V. Bradlaw, *C.B.E.*, F.R.C.S., was co-opted to the Council for the year 1950–51.

The following examiners were elected for the ensuing year :

A. Board of Examiners for the Fellowship in Dental Surgery (*Surgical Section*) : L. E. C. Norbury, P. H. Mitchiner.

B. Board of Examiners in Dental Surgery (*Surgical Section*) : N. L. B. V. Eckhoff, A. W. Kendall, S. H. Wass, A. C. Brewer, D. N. Matthews, E. C. B. Butler.

L.D.S. (*Associate Examiners*) *Properties of Dental Materials and Practical Dental Mechanics* : J. Osborne, E. Matthews ; *Anatomy* : J. Short ; *Physiology*, C. C. Vass.

F.D.S. (*Primary Examination*) : *Dental Section.*—E. B. Manley, T. Talmage Read, G. L. Roberts, M. A. Rushton ; *Anatomy.*—A. M. A. Moore, R. J. Last ; *Physiology.*—D. T. Harris; *Pathology.*—W. D. Newcomb.

Faculty of Dental Surgery

The third anniversary of the Faculty of Dental Surgery of the Royal College of Surgeons of England is to be celebrated on Friday, July 14, 1950. All Fellows and Licentiates in Dental Surgery of the College are invited to attend the following functions to be held at the College, Lincoln's Inn Fields, W.C.2. Annual General Meeting, 3 p.m. ; Charles Tomes Lecture by Professor Lester Cahn of Columbia, " The Jaw in Metabolic Disease," 3.45 p.m. ; Charles Tomes Lecture by Professor A. B. P. Amies of Melbourne, " Epulides," 5 p.m. ; Annual Dinner (Evening Dress and decorations), 7.30 for 8 p.m. Tickets £2 2s., including wines. Fellows and Licentiates may be accompanied by their wives. Applications for tickets for the dinner should be made to the Secretary, Faculty of Dental Surgery, Royal College of Surgeons, Lincoln's Inn Fields London, W.C.2.

THE BRITISH SOCIETY OF PERIODONTOLOGY

An Extraordinary Meeting of the Society will be held on Wednesday, July 19, 1950, at 8 p.m., at the Institute of Dental Surgery, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1. A paper, illustrated by slides, will be read by Dr. Gösta Lindblom upon " Prosthetic Restorations in the Closed Bite." This meeting will be open to all members of the profession. Dr. E. Wilfred Fish, *C.B.E.*, will take the Chair.

BRITISH DENTAL STUDENTS' ASSOCIATION

The Annual Convention of the B.D.S.A. is to be held at Guy's Hospital, London, from Monday, July 24 to Friday, July 28, inclusive. The Annual Meeting of the Association will be held on Tuesday, July 25, at 2.30 p.m. The programme includes an attractive series of lectures. On Tuesday morning Mr. F. N. Doubleday is to give a lecture " Some Chemical and Physical Properties of the Silicate Cements " and Mr. K. P. Pringle one entitled " Serial Study of Occlusion from Birth to Ten Years of Age." On Friday morning Dr. E. Gwynne Evans is to speak on " A Study of Muscle Behaviour in Relation to Some Orthodontic Problems " and Dr. Keith Simpson on " Crime and the Dentist." An attractive programme of social events, entertainments and conducted tours has been arranged, the culminating feature being the Annual Dance of the B.D.S.A. at the Bridge House Hotel. Further information with respect to the Convention can be obtained upon application to G. F. Thompson, The Dental School, Guy's Hospital, London, S.E.1.

DENTAL BOARD OF THE UNITED KINGDOM

Educational Films

At the recent session of the Dental Board the Educational Grants Committee reported that the Advisory Committee on Visual Education in Dentistry had reported that since July, 1949, some forty films had been appraised by a panel of members of the Advisory Committee to which specialists in particular branches of dentistry had been co-opted.

Attention had been given to the implications of setting up a central library of dental films, to the facilities required for acquiring, storing, maintaining and distributing suitable films, and to existing film distributing organisations.

The Advisory Committee were agreed that there was an urgent need for some organisation to undertake the classification of films of value in dental education, and for creating the nucleus of a central library. This would entail an expenditure which might well be considered prohibitive for an untried project. They therefore recommended a less ambitious scheme, namely the reproduction of a selection of the best films which they had appraised and their distribution by the Board through the agents who were responsible for the maintenance and distribution of the Board's films used for dental health education. It was estimated that the full cost of copying twenty films with the addition of titles and commentaries would be in the region of £1,500.

The Advisory Committee reported that they had consulted the Dental Education Advisory Council who were of the opinion that the work being done by the Committee on the question of visual education in dentistry was most valuable and that the schools would welcome the establishment of a central film organisation. If such an organisation were in fact established, there could be little doubt but that dental schools would make use of it and might well be prepared to contribute towards its maintenance.

The Committee considered that it was of great import-

ance that the work of the Advisory Committee should continue.

The information when catalogued would be invaluable, not only to the dental schools but also to other interested organisations, and they recommended that the problem of setting up a permanent central dental film library should be explored in greater detail and that, as a preliminary, the Board should finance the copying of certain films to be selected by the Advisory Committee, it being emphasised that the Board would not be in a position to maintain continuing financial support for this project. It was hoped that the authorities of the dental schools and other interested organisations would be convinced of the value of the scheme and be prepared to assume financial responsibility for its more permanent establishment.

The Board adopted the recommendations of the Educational Grants Committee that the Advisory Committee be thanked for their reports and be informed that the Board are prepared to finance the copying of films which in the opinion of the Advisory Committee are of exceptional value for teaching purposes and which are not available for general distribution, and that a sum not exceeding £1,500 be made available for this purpose out of the allocation for Educational Grants.

SCHOOL DENTAL SERVICE

THE serious position of the school dental service was discussed at the annual conference of the Association of Education Committees held at Scarborough on June 23. A resolution was carried expressing alarm at the rapid disintegration of the school dental service, and calling on the Minister of Education to take urgent steps, in collaboration with the Minister of Health, to restore the school dental service at least to the state of effectiveness it had attained before the passing of the National Health Service Act.

In the discussion which preceded the adoption of this resolution Brigadier J. H. Vaizey put forward a suggestion that all dentists on first qualifying should be required to work for local authorities for two years in order to provide an adequate school dental service.

Speaking in the same debate Mr. Stanley Hirst said "Rightly or wrongly, local authorities have taken the line that they are not prepared to compete with the salaries available to dentists in private practice under the National Health Service."

STANDARDISATION OF DENTAL SYRINGES

THE Surgical Instrument and Medical Appliances Industry Standards Committee of the British Standards Institution has commenced work on the preparation of draft British standards for hypodermic needles (medical and dental) and dental syringes. Drafts of the proposed standards will be circulated to interested organisations in due course as and when they are completed.

The Schools

DENTAL STUDENTS

IN a written reply the Minister of Health said that the annual pre-war intake of students in dental schools in the United Kingdom was about 400. The corresponding figure in 1950 was between 600 and 700 fluctuating according to the places available. The number of applicants greatly exceeded the number of vacancies.

Examination Results

Royal Faculty of Physicians and Surgeons of Glasgow.—*H.D.D.*—W. G. Browne, W. Gray, L.D.S. *D.D.O.*—B. E. Fainsinger, D. Logie, A. S. Peacock, Joan G. Ritchie, B. N. Watkins.

University of Bristol.—*Final B.D.S.*—D. C. Berry, J. S. Cooper. *Final* L.D.S.—A. H. Chivers, E. K. Joseph, J. J. Tittle.

The Services

Birthday Honour.—Squadron Leader R. J. Newman, R.A.F.V.R., was created *M.B.E.* in the Birthday Honours List.

Territorial Efficiency Decoration.—His Majesty the King has been pleased to approve the award of the Territorial Efficiency Decoration (T.D.) to Major K. A. Smith, Royal Army Dental Corps (T.A.).

NAVAL PROMOTIONS

THE following promotions are announced by the Admiralty:—

Royal Navy.—Surgeon Commander (D) to Surgeon Captain (D): R. J. M. Andrews (Acting Surgeon Commander (D)).

Surgeon Lieutenant-Commander (D) to Surgeon Commander (D): W. I. N. Forrest, R. A. Hilton (Acting Surgeon Commander (D)).

R.N.V.R.—Surgeon Lieutenant-Commander (D) to Surgeon Commander (D): A. C. Fuller.

Obituary

JOHN THOMAS JAMESON, M.D.S.Dunelm, F.D.S. R.C.S.Eng., L.D.S.Edin.

THE dental profession in the North lost a prominent member by the death on May 28 of J. T. Jameson of Newcastle-on-Tyne at the age of 87. Mr. Jameson (Tom to his many friends) qualified L.D.S.Edin. in 1890, he was one of the students at the Edinburgh Dental Hospital when it was situated in Lauriston Lane before it moved to Chambers Street.

After qualifying he began practice in Ridley Place, Newcastle, and rapidly built up a large and high-class practice, he then moved to Windsor Place for a few years and then to No. 11, Windsor Crescent where he practised for many years. He was an artist in conservative dentistry and some of his fillings and crowns were beautiful work.

He was one of the six founders of the Newcastle Dental Hospital and School and he was for several years the second Dean of that Institution and when he reached the age limit for active service he was made an Honorary Consulting Dental Surgeon to the hospital.

The University of Durham conferred on him a Hon. M.D.S. in 1941 and in 1948 the Dean of the Faculty of Dental Surgery of the R.C.S. of England conferred on him their F.D.S., this ceremony taking place in Newcastle among his many friends at a meeting of the N. Counties branch of the B.D.A.

Mr. Jameson joined the B.D.A. in 1892 and was President of the Association in 1922, he was also a past President of the N. Counties branch.

He was one of the founders of the North of England Odontological Society and the members of this thought so highly of his abilities that he was elected President on three separate occasions. The Jubilee dinner of the

Society on March 16 this year was one of the last functions he attended.

For recreation he indulged in fishing at which he was an expert and many were the good salmon he landed from the Coquet and other rivers.

Jameson was an inspiration to all who aimed at doing really good work and when others sought his advice he would devote endless time to explaining and demonstrating how they could overcome their difficulties.

Although never a robust man Mr. Jameson only retired from practice a year or two before his death. He is survived by his brother Alfred, also a dental surgeon, and two daughters, both married, to whom the sympathies of all are extended.

DONALD TOM GORDON DICKENS, L.D.S.Eng.

An Appreciation

G. E. writes :

A native of Peterborough, Donald T. G. Dickens saw service in the Tank Corps in the 1914–1918 war, leading his tank into the last great battles of 1918.

After the war he returned to Guy's, qualifying at the end of 1920. He eventually settled in Reading in 1922, where he scored an immediate and enduring success.

He became the Honorary Dental Surgeon to the Royal Berkshire Hospital and Dental Surgeon to the Berks, Bucks and Oxon Tuberculosis Sanatorium, both of which posts he occupied until his retirement.

He was a founder member of the Reading and District Section of the Association, and acted as secretary and chairman on many occasions.

His sudden illness and retirement at the beginning of 1947 came as a great shock to his friends and colleagues, and now his untimely death in his early fifties, after so short an enjoyment of the lovely house in Oxfordshire to which he retired, is hard to believe.

Dicken's greatest characteristic was his tremendous upright, straightforward and direct nature. He feare nothing, he baulked at nothing, and if necessary he stud at nothing.

He went straight to the heart of every matter, great o small, in which he was engaged and never spared himself It was this that gained him his innumerable and abidin friends, and many can testify that he and his wife, wh was his inseparable companion, were in their happies element when displaying the gift of steadfast friendshi

Our great sympathy goes to his widow, but she mus be very proud that of her husband it can be said s fervently, " He ran the straight race."

Marriage

ASHALL—WORRALL.—On June 8, a All Saints' Church Runcorn, Reginald W. Ashall, B.D.S., of Widnes, Lancs, to Mar Mildred Worrall, of Runcorn, Cheshire.

Deaths

DICKENS.—On Thursday, June 15, 1950, Donald T. G. Dickens L.D.S. R.C.S.Eng., of Rotherfield House, Peppard, Nr. Reading.

MORRIS.—On Monday, June 26, 1950, Henry James, L.D.S R.C.S.Eng., of 13, Fairfield Avenue, Felixstowe and formerly o Sheffield. Aged 75 years.

Our Diary

Monday, July 10—*Friday, July* 14.

British Dental Association.—Annual Meeting, University o Birmingham.

Friday, July 14.

The Royal College of Surgeons of England.—Charles Tome Lectures, the College, Lincoln's Inn Fields, W.C.2. 3.45 p.m. "The Jaws in Generalised Skeletal Disease," Professor Leste Cahn ; 5 p.m., " Epulides," Professor A. B. P. Amies.

Sunday, July 16.

British Dental Association Photographic Society.—Rive Picnic at Henley. Members wishing to attend should get in touch with Mr. E. L. Wyatt, EALing 2933.

Wednesday, July 19.

British Society of Periodontology, Open meeting, Eastma Dental Hospital, Gray's Inn Road, London, W.C.1, 8 p.m. " Pros thetic Restorations in the Closed Bite," Dr. Gösta Lindblom.

Saturday, July 22.

Eastern Counties Branch.—The Red Lion Hotel, Petty Cury Cambridge. 10.30 a.m., Business Meeting; 11 a.m. " Observation on my American Visit," R. G. Swiss ; 2.15 p.m. " Changing Method of Denture Production especially in regard to Dental Castings."

Monday to Friday, July 24 *to* 28.

The British Dental Students' Association.—Annual Conven tion, Guy's Hospital, London, S.E.1. Tuesday : 10 a.m., " Some Chemical and Physical Properties of the Silicate Cements," F. A. Doubleday ; 11.30 a.m., Film " Serial Study of Occlusion from Birth to Ten Years of Age," K. Pringle ; 2.30 p.m., Annual Genera Meeting. Friday : 10 a.m., " A Study of Muscle Behaviour in Relation to some Orthodontic Problems," Dr. E. Gwynne Evans 11.30 p.m., " Crime and the Dentist," Dr. Keith Simpson ; 7 p.m. Annual Dance, Bridge House Hotel.

INDEX FOR JANUARY 6 TO JUNE 16, 1950

Readers desiring to bind their volumes of the " British Dental Journal " for the period January 6 to June 16, 1950, can obtain copies of the title page and index on application to the Journal Manager at 13, Hill Street, Berkeley Square, London, W.1.

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